# © EDM VISION™

VISION Readout System for EDM Machines



## REFERENCE MANUAL



#### Page Table of contents

Li un salup bered topi ... .....

#### Section 1. Installation

Introduction	gipologe firetog tree-V
The modular concept	1-1
Angenerica	and the same of the same of the same property.
First-Spark Detector	1-2
Edge Finder Probe	1-2
2-Axis Module	1-2
CFI Module	1-3 Phon culgati (ALIII
VISION Option Module	1-3
Foot Switch assembly	
Parallel Printer	
Storage device	
Bench testing	
Installing/removing modules	1-5
Connecting ground, checking voltage, connecting power	
Power-up test	1-10
Keypad test	1-12
Video test	1-13
Memory test	
WS	
Installing the EDM VISION measuring system	280,630
Selecting location	
Proper mounting	
Connecting encoders	1-18
External Z-axis controls	
Connecting accessories	
Connecting ground, checking voltage, connecting power	
Initial system power-up	1-26
	Det.

### Section 2. Getting acquainted with EDM VISION features

Part of the background for

Front panel controls	2-1
Display screen	2-1
DRO (digital readout) display mode	2-2
Measurement display window	2-2
Information windows	
EDM display mode	
Measurement display window	
Information windows	
Keypad	2-7
Menu keys	2-7
Axis keys	
ZERO ŘESET	
Numeric keys	2-8
REF	
INCR	2-8
AB\$	2-9
CLEAR	2-9
INCH/MM	2-9
DEG/DMS	
SET SYS	2-9
DATUM	2-9
SET POINT	2-9
EDGE FIND	
PRINT	
HOLE PTRN	2-10
CALC	2-10
HELP	2-10
Cursor-control (arrow) keys	2-10
DRO/EDM	2-10
Sleening" screen	2-11

#### Section 3. SET SYS: EDM VISION setup operations

Setting axis parameters		3-2	
Password protection		3-2	
	parameters		
Setting error compens	ation	and the most control of	Mind white DRD disk
Machine geometry	/ errors	3-12	RESTORED CHARLES
Measuring errors		3-12	
	compensation values		
	e-interval error compensation		
Setting single-inter	rval error compensation	3-18	
Manual entry or ed	diting of single-interval	and a remaining partition All	TACLED SHALL
error compensat	ion values	3-24 ML 14	Selection S
Setting multiple-int	terval error compensation	3-26	William HALE
Setting the Ho	ome Reference Point	3-29	Ulfrink Stille
Using the auto	omatic routine to establish		Sydring You
multiple-inte	omatic routine to establish rval error correction factors	3-32	ud) to the S
Manual entry or ed	diting of multiple-interval ion values		to a production
Satting the Home Reference	e Point	2.40	
Setting the Florite Reference	e rollik	3-40	9.60
Setting DRO and EDM disp	lays 31	DMF light onto the deplies	MIX. CO.
Display Axes: selec	cting axes for the display	3-45 https://www.	ng grif
Display Resolution	cting axes for the display s setting the least-significant-oments Warning: setting a dimension warning	ligit for	TOWNSHIP OF THE TOTAL PROPERTY.
display measurer	ments	3-46	WHEN STREET TOWNS AND IN
Approaching Zero	Warning: setting a dimension	for the	mindred and the second
flashing display v	warning	3-50	
EDM display format		3-51	Modificacy 603M (disc)
Miscellaneous		3-52	
Resetting memory		3-52	Presente
Tests		3-53	shari wheelt
	ation		
	n		
			BOX HOT JOSEP LOUAD
			Föor Vincentin o
	tion		Pingal cilculor
	tics		one has some
			and the same
	tion		
	tics		S. March Co.
			Service Anglish
Jump to a prior point within	the setup program		

EDM VISION

1862, 777, 2

Section 4. EDM contracts

#### Section 4. EDM operations

Section 4. EDM operations	NACHONIA SERIE SYLESTER IN MORE	
Getting started	4-1	
DRO mode: setting up for EDM operations		
DRO mode display		
Modifying the display with parameter settings		
Single-key DRO display modification features		
Multi-key DRO display modification features	mike it all to make all the last	
Zero resetting		
Presetting the incremental measurement		
Presetting the absolute measurement		
Using reference presetting		
Using the DATUM setting routine		
Selecting DATUM points		
Setting DATUM points		
Edge finding		
Getting started	4-18	
Setting the offset for a symmetrical	AND THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.	
Probe or electrode	4-19	
Setting the offset for a non-symmetrical		
probe or electrode		
Using the edge find routine		
Locating edges with the edge finder		
Zero on edge detection		
Two-point calculations	4-35	
EDM mode: performing electrical discharge machining opera	ations	
EDM mode display	4-42	
Modifying the display with parameter settings		
Single-key EDM display modification features		
Multi-key EDM display modification features		
Zero resetting	4-44	
Presetting		
The first-spark detection (edge find) routine	WATER A 200	
Using the DATUM setting routine		
Controlling EDM parameters with EDM VISION		
Common EDM control needs		
Using the EDM controls		
and the second of the second second in the second s	4-49	
Features that replace the DRO and EDM mode displays		
CALC: using the calculator	4-52	
Four-function calculator	4-52	
Preset calculator		
Taper calculator		
SET SYS: using the parameter setting feature		
HOLE PTRN: using the hole pattern feature		
SET POINT: using the point setting feature		
Edge Finder offsets		
Locate Machine Zero	4.60	
Spark Points		
HELP: using the help feature		
	700	
Saving settings	4-66	

#### Section 5. Accessories Introduction ...... 5-1 First-spark detector ...... 5-1 Edge Finder Probe ...... 5-3 VISION 2-Axis Module ...... 5-5 VISION CFI Module ...... 5-5 VISION Option Module ...... 5-9 Edge Finder receptacle ...... 5-10 Foot Switch receptacle ...... 5-11 Parallel printer port ...... 5-11 RS232-C serial ports 1 and 2 ...... 5-11 Sending data to EDM VISION ...... 5-12 Requesting data from EDM VISION ...... 5-15 Using an external video monitor ...... 5-17 VISION Foot Switch ...... 5-17 Parallel Printer ...... 5-17 Storage device (external computer) ...... 5-19 Section 6. Appendices A. Troubleshooting Ventilation system ...... 6-1 "CHECK FILTER" faults and remedies ...... 6-1 Fuses ....... 6-2 Software errors ...... 6-3 Error recovery ...... 6-4 Other errors ...... 6-5 Hardware identification ...... 6-5 B. EDM VISION specifications ...... 6-7 D. Z-axis connector and output specifications ...... 6-11 E. VISION Option Module connectors ...... 6-15 F. Parameter default settings ...... 6-21 G. Advanced error compensation techniques ...... 6-23 H. Glossary ...... 6-35

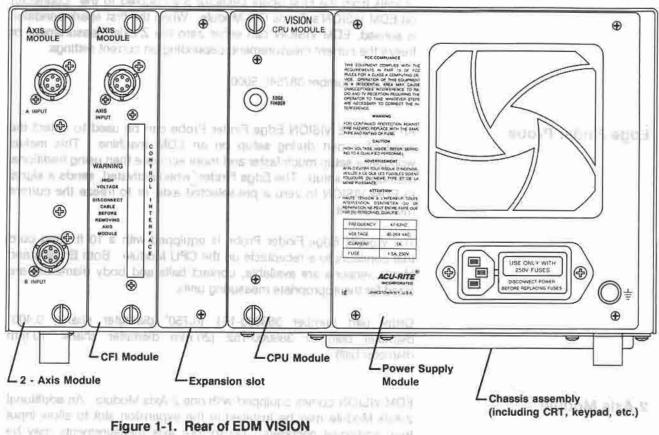
I. Warranty ...... 6-37

#### Section 1. Installation

EDM VISION was designed and built as a modular unit that speeds assembly and repair. The chassis assembly with video display unit, the encoder modules, the central processing unit (CPU), and the power supply assembly are all modular units. The 2-Axis, CFI, and CPU Modules are slide-in P.C. board assemblies. The CPU Module is installed in a special slot; this slot will accept only a CPU Module. Three other module slots are available; they are designed so that 2-Axis Modules, CFI Modules, or Option Modules may be Installed in any of these slots. EDM VISION comes equipped with a 2-Axis Module in the first slot, and a CFI Module in the second; the third slot is available for expansion.

#### Introduction The modular concept

Accessories



EDM VISION was designed to make installation of additional modules or module replacement as easy as possible at the installation site. This reduces the amount of down time when adding features, or if problems develop.

Changing modules is the only level of maintenance authorized by ACU-RITE. The viewing screen (CRT) and chassis assembly cannot be maintained in the field. If a problem develops that is not a modulerelated malfunction, the entire unit must be returned to the ACU-RITE Distributor, original equipment manufacturer, or to the ACU-RITE Service Center for repair.

#### Accessories

The following accessories are available to enhance your EDM VISION measuring system. These accessories provide additional functions and capabilities to create a customized solution to your measuring system needs. To order these accessories, contact your ACU-RITE Distributor or original equipment manufacturer, or call ACU-RITE Customer Service at (800) 344-2311.

CPT Wordles are oldered C board assembles. The CPD Module is

#### First-Spark Detector

Introduction

The modular concept

The First-Spark Detector is an accessory made especially for EDM VISION. The First-Spark Detector is used to establish the workpiece/tool relationship. The detector senses the first spark that is established between the workpiece and the EDM tool as the EDM ram is brought next to the workpiece. This effectively establishes the workpiece zero point.

Signals from the First-Spark Detector are coupled to the connector on EDM VISION's Z-axis CFI Module. When the first spark condition is sensed, EDM VISION can either zero the Z-axis measurement or freeze the current measurement, depending on current settings.

Order part number 387540-5000.

#### **Edge Finder Probe**

An ACU-RITE VISION Edge Finder Probe can be used to detect the edge of a part during setup on an EDM machine. This makes workpiece setup much faster and more accurate than using traditional methods for setup. The Edge Finder, when activated, sends a signal to EDM VISION to zero a pre-selected axis, or to freeze the current measurement.

The VISION Edge Finder Probe is equipped with a 10 ft. long cord that connects to a receptacle on the CPU Module. Both English and Metric versions are available; contact balls and body diameters are sized for the appropriate measuring units.

Order part number 388000-151 (0.750" diameter shank, 0.400" diameter ball) or 388000-152 (20 mm diameter shank, 10 mm diameter ball).

#### 2-Axis Module

EDM VISION comes equipped with one 2-Axis Module. An additional 2-Axis Module may be installed in the expansion slot to allow input from additional encoders. Up to four axis measurements may be displayed at once in the DRO mode.

Charging rections in the volume of the common antended by an expensive authorities of the common and artists of the common

Order part number 387802-6000.

EDM VISION is equipped with one Control Function Interface (CFI) Module as standard equipment, for use on the Z-axis. This module works with EDM VISION internal software to provide control for Z-axis movements during EDM operations.

An additional CFI Module may be installed in the expansion slot. It can control movements on another machine axis. This module will operate the same as CFI Modules installed in any of the VISION products; none of the special features provided for control of the Z-axis with EDM VISION are provided for the additional axes.

The Module is equipped with one encoder connector and a special receptacle for the control signals. The mating connector is provided for attachment of wiring to control points on the machine.

The control signals available from the additional CFI Module are different from control signals provided by the Z-axis CFI Module. Like the Z-axis CFI Module, the added CFI Module provides output signals that correspond to the status of the measurement displayed for that axis. For the additional Module, however, the signals correspond to two less-than-or-equal-to boundary values; and for less-than, equal-to, and greater-than zero. A fault signal is provided to flag problems with measuring signals on that axis, and an "On" signal is provided to allow these CFI controls to function.

Order part number 387802-6001.

EDM VISION can be enhanced by installing a VISION Option Module in the expansion slot. This module provides bi-directional RS232-C communications on two ports, connection to a parallel printer, use of the ACU-RITE Foot Switch, and an output to drive an external video display. Option capabilities are explained in detail in the tab section "ACCESSORIES". The Option Module is required when installing the Foot Switch, Parallel Printer, or Storage device accessories.

Order part number 387800-4060.

The ACU-RITE Foot Switch assembly can be used as a remote PRINT key. The Foot Switch assembly is equipped with a 10 ft. long cord that connects to a receptacle on the ACU-RITE VISION Option Module. The VISION Option Module is required for use with this accessory.

Order part number 388000-150.

CFI Module

**VISION Option Module** 

Foot Switch assembly

#### Parallel Printer

The ACU-RITE Parallel Printer can be used to provide a printed record of important EDM measurements. The parallel printer comes equipped with a cable that connects to a receptacle on the ACU-RITE VISION Option Module. The VISION Option Module is required for use with this accessory.

When the [PRINT] key on EDM VISION's keypad is pressed, the current measurements shown on the display are printed on the Parallel Printer. These may be either DRO or EDM mode measurements, depending on current settings. Printing may also be initiated by pressing the Foot Switch if that accessory is installed.

Order part number 388000-103.

#### Storage device

The ACU-RITE Storage device is a lap-top computer that can operate as a remote input device for EDM VISION, or to request and/or receive data from EDM VISION for data logging or process recording purposes. The Storage device comes equipped with software for normal operation as a stand-alone computer, and with cabling to connect to a receptacle on the ACU-RITE VISION Option Module. The VISION Option Module is required for use with this accessory.

acudosmi administrator seman emportar la transcriuta ad

Order part number 388000-250.

VISION Option Module

EDM off Division by unburous to provide a visitor upper had all as the period of the provide and sectional institution or an expension of the period of the

Foot Switch assumbly

THE STATE AND THE PROPERTY OF THE PROPERTY OF THE STATE O

Prior to installation, a simple bench test should be run to confirm that EDM VISION is operating properly. If additional modules were purchased separately with EDM VISION, they should be installed before proceeding with bench testing and installation. Accessories should also be attached to verify that they are operating properly. Refer to Section 5. Accessories for instructions on how to connect accessories to EDM VISION, and for explanations of accessory operations.

#### **Bench testing**

Installing/removing modules

#### CAUTION

with all wight of made on with as early take well for all appoints on

Power must be removed from EDM VISION prior to installing Modules. Leaving power on while installing Modules may damage the Module or EDM VISION

#### CAUTION

If installing an Option Module, a jumper on the CPU Module must be moved. If the jumper is not set properly, the CPU or Option Module may be damaged.

#### To install a new or replacement module:

- Turn the EDM VISION power switch (located on the front) to OFF. Unplug the unit.
- If necessary, remove the screws at the top and bottom of an empty slot at the back of EDM VISION. Remove the cover plate and set the plate and screws aside. Save them for future use.

#### Bench testing

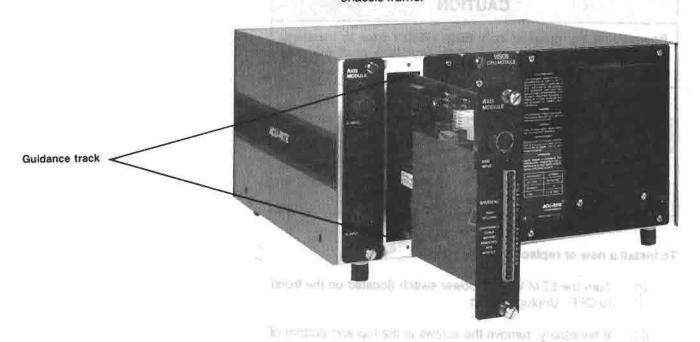
installing/removing

modules

Slide the new module into the chassis, aligning the board with the tracks at top and bottom. Some resistance will be felt when sliding the module in the last half-inch; the connector on the module is making contact with the connector in the chassis. Do not force the module into place.

Skill militural at humand bluoriti land riberra reserve is unacatement or solve

Slide the module completely forward to seat the connector, until the rear plate of the module is tight to the chassis frame.



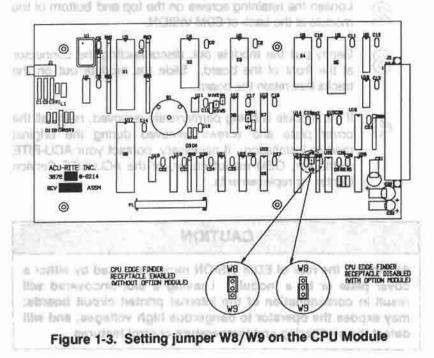
much sound electromagnetic for the sound probability and sound so

4

Tighten the retaining screws finger-tight.

If an Option Module was installed, remove the CPU Module. Locate jumper W8 (Figure 1-3). Remove the jumper and install it in the W9 location. Re-install the CPU Module (steps 3 and 4 above).

To remove a module:



#### To remove a module:

- Turn the EDM VISION power switch (located on the front) to OFF. Unplug the unit.
  - Loosen the retaining screws on the top and bottom of the module at the back of EDM VISION.

Module Especia Bard 4 scower

- Gently pull the module out, disconnecting the connector at the front of the board. Slide the module out on the tracks that retain the board.
- If the module is being permanently removed, re-install the cover plate and screws removed during the original module installation. If necessary, contact your ACU-RITE distributor, OEM manufacturer, or the ACU-RITE Service Center for replacements.

#### CAUTION

All slots at the rear of EDM VISION must be closed by either a cover plate or by a module. Leaving a slot uncovered will result in contamination of the internal printed circuit boards; may expose the operator to dangerous high voltages; and will defeat the air filtering and temperature control features.

Connect a ground wire from the terminal at the back of EDM VISION to the EDM machine. The machine should also be connected to a solid earth ground.

controlled to the State of the security of the security of the security of

Connecting ground, checking voltage, connecting power

#### **IMPORTANT**

Installing and maintaining a solid ground path of minimum length is extremely important. EDM machines tend to generate high levels of radio-frequency energy (usually termed RFE or RFI) that can interfere with the counting signals produced by the encoders.

Confirm the voltage available at the power source for connecting to EDM VISION. Refer to Appendix B in <u>Section 6</u>. Appendices for a listing of the voltage range that is acceptable for use with EDM VISION.

#### CAUTION

Connecting EDM VISION to a power source outside of the acceptable range may damage EDM VISION or the encoders.

Connect EDM VISION to the power source using the power cord supplied.

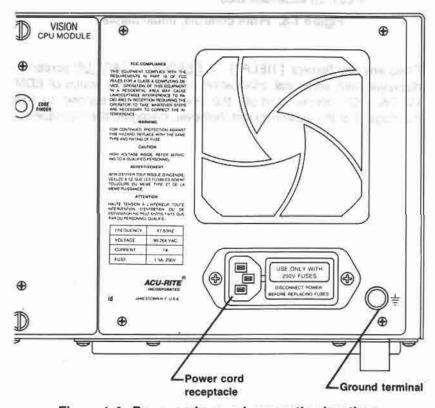


Figure 1-4. Power and ground connection locations

#### Power-up test

čhesking voltage,

connecting pawer

Turn the power switch (located on the front of EDM VISION) to ON. "EDM VISION BY ACU-RITE" should appear as an initial display. This display also indicates the version of internal operating software installed in EDM VISION, and will be different from that shown in Figure 1-5.

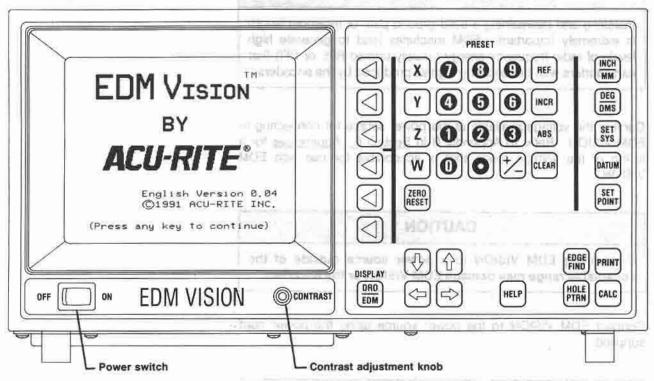


Figure 1-5. Front controls, initial display

Press any key (except [ HELP ]). A <u>READOUT START-UP</u> screen is displayed with additional information concerning the status of EDM VISION. On normal start-up, the operator must respond to this message. For this power-up test, however, disregard the message.

Printed of spottering Leagues and the amount of the printed

Press the [SET SYS] key (located on the right side of the keypad) to continue with the bench tests.

on the light acts of the display



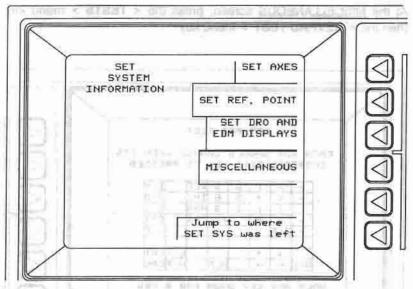


Figure 1-6. <u>SET SYSTEM INFORMATION</u> screen, showing menu keys

This is the main screen for the SET SYStem function, which allows EDM VISION to be configured for specific installations. If an Option Module was installed, one additional menu key will be shown.

Hard offeet to be provided in a processor of the supplemental values of the supplemental of the supplement

#### Keypad test

Press the < MISCELLANEOUS > menu key. Menu keys are the keys along the left side of the keypad, that correspond to messages on the right side of the display.

At the <u>MISCELLANEOUS</u> screen, press the < **TESTS** > menu key, then the < **KEYPAD TEST** > menu key.

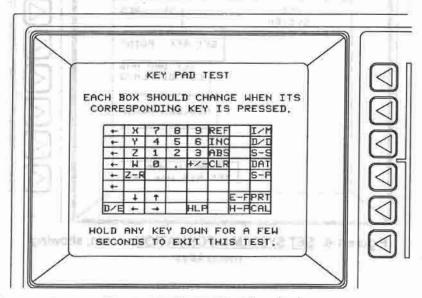


Figure 1-7. Keypad testing display

metric of the gold much association (c), benefit of any blackets

The display screen shows a representation of the keypad. Verify that all keys are functioning by pressing each key in turn. The key's location on the screen will become highlighted to acknowledge the key-press; if pressed again, the highlight turns off. When finished with the key test, hold down any key for a few seconds to return to the <u>TESTS</u> screen.

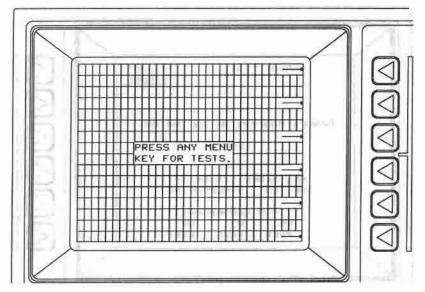


Figure 1-8. Video test display

The video test displays a grid pattern on the screen. The grid lines should be straight, both vertically and horizontally. Arrows along the right hand side of the screen should line up with the center of the menu keys. Press any menu key to end the video test and return to the <u>TESTS</u> screen.

RAM testing bitgers immediately rates ROM testing in counteledd. (Incompany) explores the counteled to the strong testing regions that address training testing through the strong testing acceptance and trianguage surrounced try processes tray of VESTS MEANT is uncourage.

Flustry MANI strongly locations detected and section of the Utgatery Theorem and socially probably at trustry ROWs. If a protect with the importal program containing on the ROW manney is expected, operand the most RITE Sendos Complete the ROW object during expected for the vision of bott-wis literature. It interests problem is extractly profuse your ALCU to exploit or one CEW.

Freez shy: c TESTS MEDSU a much very its rotour to the TESTS

If necessarily have been invitied, each to them already to tempt a country of them already to pedage and the control of the co

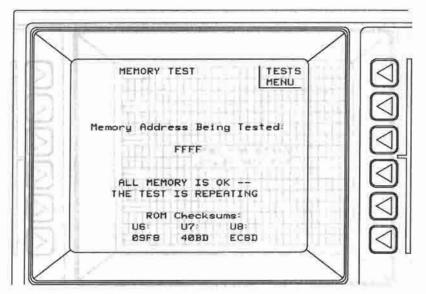


Figure 1-9. Memory test display

The memory test checks both the read-only memory (ROM) and the random access memory (RAM). Testing of the ROM yields a check-sum; a number corresponding to the check-sum will appear on the screen when the test is complete (they will be different from those shown in Figure 1-9; they will correspond to the software version shown on the opening screen).

RAM testing begins immediately after ROM testing is completed. The display indicates the current RAM address being tested. When the test is successfully completed, a message appears on the screen. The RAM test continues until interrupted by pressing the < TESTS MENU > menu key.

Faulty RAM memory locations detected are indicated on the display. There is no specific indication of faulty ROMs. If a problem with the internal program contained in the ROM memory is suspected, contact the ACU-RITE Service Center to verify the ROM check-sums expected for the version of software installed. If a memory problem is indicated, contact your ACU-RITE distributor or OEM.

Press the < TESTS MENU > menu key to return to the <u>TESTS</u> screen.

If accessories have been installed, each of them should be tested prior to installing them on the EDM machine. Refer to <u>Section 5</u>. Accessories for instructions about settings that must be made and instructions about working with the accessories.

#### IMPORTANT

If any of the above steps cannot be completed or if any of the screens differ from the above descriptions, contact your ACU-RITE distributor or OEM for further instructions. Installing the EDM VISION measuring system

When all tests have been completed, turn the unit off. Remove the ground wire, power cord, and any accessories to prepare for installation.

Spiecting location

- ESM-YERCH should be within exalt intent) of the operativition accommission within legiplet and other confide.
- EDta VISIDN shootd by in approximate mys lavar and street trivevite the oppositer.
- a svold staving parapanents or boots, and obolist splash of soray
- with counting any orintern must be within the unique of 0° to 40° C (20° to 104-75, with a non-chrosensing inturval numetry is setting that
- ECA VISICN must rest interquent motion around and uniter the part. Access to the first entiroply to required for periodic constant or
- EDM VISICING inquiary, film all DRZs can Lie advirtually affected bit is served imagnistic field. Therefore, it should be innerstand avverage any strong source of magnetism. Magnetisc comlysistem should work this set on top of EDM VISICIN.

#### Installing the EDM VISION measuring system

#### IMPORTANT

Before installing EDM VISION, record the serial number in the Warranty appendix in the back of this Reference Manual. The serial number label is located on the bottom of EDM VISION.

#### Selecting location

Selecting a location for EDM VISION is an important consideration for a proper installation. Keep the following points in mind when selecting a safe and convenient location:

- EDM VISION should be within easy reach of the operator for access to the keypad and other controls.
- EDM VISION should be at approximate eye level and tilted towards the operator.
- avoid moving components or tools, and coolant splash or spray.
- the operating environment must be within the range of 0° to 40° C (32° to 104°F), with a non-condensing relative humidity of 25% to 95%.
- EDM VISION must have adequate airflow around and under the unit. Access to the filter assembly is required for periodic maintenance.
- EDM VISION's display, like all CRTs, can be adversely affected by a strong magnetic field. Therefore, it should be mounted away from any strong source of magnetism. Magnetic base holders should never be set on top of EDM VISION.

ACU-RITE has developed special mounting kits for EDM VISION which address the most common mounting requirements. These kits are available from your ACU-RITE distributor and come complete with hardware and mounting instructions.

Proper mounting

If fabricating a support device for EDM VISION, it should be large and strong enough to accommodate the readout and any other devices that may be placed on top (printer, etc). It must also be stiff enough to minimize any vibration induced by machinery on the shop floor; vibration will make the displays difficult to read and can lead to premature failure.

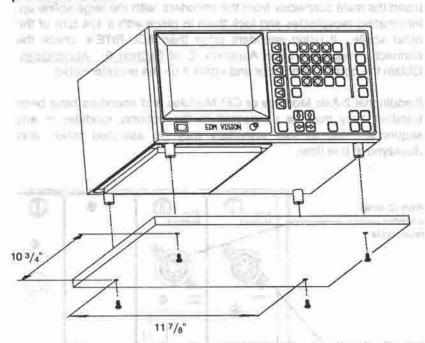


Figure 1-10. Mounting EDM VISION using the ACU-RITE mounting kit

at the second of the second of the second of

ainsi yi bassaro na fenifiki arrisa seti ribadi. Aikin aristom si

#### Connecting encoders

After encoders have been installed on each axis of the machine, the encoder connectors must be plugged into the back of EDM VISION.

The encoder input receptacles on the 2-Axis Module are labeled "A INPUT" and "B INPUT", and "AXIS INPUT" on the CFI Module. The connector from the encoder installed on the EDM ram must be connected to the CFI Module. This axis will be labeled as the Z-axis on EDM VISION. Either of the other two encoders' connectors may be installed on the "A INPUT" or "B INPUT" receptacles; each input is assigned an axis label (X or Y) when the encoder parameters are set.

Insert the male connector from the encoders, with the large spline up, into mating receptacles and lock them in place with a 1/4-turn of the outer shells. If using encoders other than ACU-RITE's, check the connector requirements in Appendix C of Section 6. Appendices. Obtain the correct connector and install it on the encoder cable.

If additional 2-Axis Modules or CFI Modules and encoders have been installed, they may be connected to the optional modules in any sequence. Up to four encoders may be assigned labels and displayed at one time.

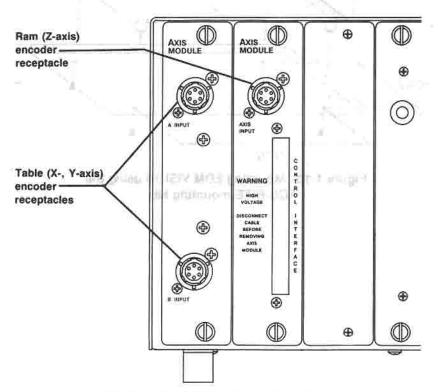


Figure 1-11. Axis connector locations

Provide enough slack in the encoder cables to allow for full travel of all machine axes. Assure that cables will not be pinched by table movements.

#### CAUTION

The EDM machine controls should be modified only by a qualified electronic technician, and only after thoroughly examining Z-axis wiring diagrams supplied with the EDM machine. The technician must have a thorough knowledge of EDM VISION Z-axis operations and features. Additional circuitry may be required to allow EDM VISION to work with the EDM machine.

The technician should prepare an addendum to the EDM machine operator's manual, describing the EDM machine operations under EDM VISION control.

Careful consideration must be given to the operation of the EDM machine features and EDM VISION controls to avoid damage to the EDM machine or to EDM VISION, and to prevent any risk of injury to the operator.

THE WINDSHIP OF THE POLICE OF THE PARTY AND

EDM VISION is equipped with a CFI (Control Function Interface) Module, which is intended to work with the EDM machine's Z-axis controls. The Module has a 16-pin receptacle on the rear panel; a mating connector is provided for connecting wiring from the EDM machine control circuits.

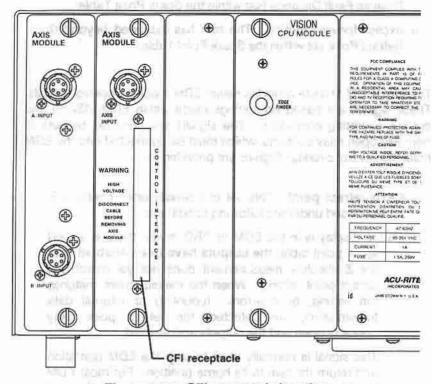


Figure 1-12. CFI receptacle location

 anem in Noba Rathdia (6.0 Obrigad) Voltandian in In TVNSF (TD-90")88 promise sold establish TVNAS\*

#### External Z-axis controls

Error checken



Although this is a standard CFI Module intended for use with any of ACU-RITE's VISION readouts, the features provided by EDM VISION are unique. Control signals are provided that can be used to control EDM machine functions based on the position of the Z-axis, especially the retract point for the EDM ram. In most cases, the ram retract point signal can replace an existing limit switch and micrometer assembly on the EDM machine.

#### Error checking

Extracts:

Z-axis controls

EDM VISION monitors four operating characteristics to check for errors, and modifies the operation of the output signals if errors are detected. Error detection and subsequent changes to the signals are intended to halt automatic EDM operations until the error is corrected, to prevent damage to the workpiece or EDM machine or injury to the operator. Some of the output signals are affected by all of the error conditions, while others are only affected by specific errors.

exclusion may be recurred to above COM VISION to work with

Errors that are monitored include:

- encoder counting errors. Counting signals from the encoder were degraded. The current measurement is unreliable and could affect the intended EDM operation.
- internal data transmission errors. Data being passed between the EDM VISION modules was not correct, and could affect the intended EDM operation.
- excess reverse motion. The movement of the ram in the direction opposite of the burn direction has exceeded the Reverse Fault Distance (set within the Spark Point Table).
- excess forward motion. The ram has extended beyond the Retract Point set within the Spark Point Table.

#### **EDM** control signals

The Z-axis CFI Module provides seven EDM machine control signals. These signals are based on settings made within EDM VISION and current operating conditions. The signals are provided by sets of normally-open relay contacts, which must be connected into the EDM machine control circuits. Signals are provided for:

- Z-axis retract point. This set of normally-open contacts is held closed under the following conditions:
  - the display is in the EDM or DRO mode, there is a valid spark point table, the outputs have been enabled, and the Z absolute measurement does not yet match the retract point setting. When the measurement matches the setting, or if errors (counting or internal data transmission) are detected, the retract point relay contacts open and the outputs are disabled.

This signal is normally used to stop the EDM operation and return the ram to its home position. For most EDM machines, it will replace existing control circuitry and mechanical adjustments.

If a movement beyond the retract point is made, a "FAULT: Absolute Pos. beyond RETRACT POINT"

message is displayed in the status window and the outputs are disabled.

the display is in the EDM or DRO mode, there is a valid spark point table, the outputs are disabled, and the Z absolute measurement does not yet match the retract point setting. When the measurement matches the setting or if errors (counting or internal data transmission) occur, the retract point relay contacts open.

This arrangement is intended to support setup operations, where the retract point signal is required to allow the ram to move during setup.

The retract point contacts will close again when the ram is raised so that the **Z** absolute measurement no longer matches the retract point setting.

If a movement beyond the retract point is made, a "FAULT: Absolute Pos. beyond RETRACT POINT" message is displayed in the status window. The message will clear when the Z absolute measurement no longer is beyond the retract point.

the <u>Automatic Edge Finder Offsets</u> or <u>Locate Machine Zero Position</u> screens are displayed (after pressing the [SET POINT] key, and either the < Edge Finder Offsets > or < Locate Machine Zero Position > menu keys).

This arrangement supports these two routines, where the retract point signal is required to allow the ram to move.

 the <u>FIND</u> the <u>FTO</u> <u>REFERENCE</u> <u>POINT</u> screen is displayed (after pressing the [SET SYS], < SET REF. <u>POINT</u> > and [Z] keys and menu keys).

This arrangement supports finding the Z-axis Home Reference Point, where the retract point signal is required to allow the ram to move.

the <u>ERROR COMPENSATION</u> screen is displayed (after pressing the [SET SYS], < SET AXES >, entering the password, and pressing the < ERROR COMPENSATION > and [Z] keys and menu keys) and no faults (encoder counting or internal data transmission) have occurred.

This arrangement supports setting the Z-axis error compensation, where the Z-axis retract point signal is required to allow the ram to move.

 the TAPER CALCULATOR screen is displayed (after pressing the [ CALC ] key twice).

This arrangement supports using the taper calculator function with an Edge Finder to find tapers by touching points along the workpiece. It allows use of the ram

where the retract point signal is required for ram movement.

Fault. This set of normally-open contacts is held closed under the following conditions:

blav a et steet - store LPD er STET ett e alleme it

- the display is in the EDM or DRO mode
- the outputs are enabled
- the spark point table is valid
- no faults (illegal reverse motion, movement beyond the retract point, encoder counting errors, or internal data transmission) have occurred.

This signal is commonly used to stop all operations when the Fault relay contacts open. This will prevent continuing advance of the ram and potential damage to the workpiece, tools, or machine.

EDM Valid. This set of normally-open contacts is held closed under the following conditions:

THOSE TOASTESS proped out so hads for I

the display is in the EDM or DRO mode and no faults (encoder counting or internal data transmission) have occurred.

The EDM Valid signal is commonly used to indicate "normal" operations, to allow ram movement.

the <u>Automatic Edge Finder Offsets</u> or <u>Locate Machine Zero Position</u> screens are displayed (after pressing the [SET POINT] key, and either the < Edge Finder Offsets > or < Locate Machine Zero Position > menu keys) and no faults (encoder counting or internal data transmission) have occurred.

This arrangement supports setting Z-axis edge finder offsets and the machine zero position, where the EDM Valid signal is required to allow the ram to move.

the <u>FIND</u> the <u>FTO</u> <u>REFERENCE</u> <u>POINT</u> screen is displayed (after pressing the [SET SYS], < SET REF. <u>POINT</u> > and [Z] keys and menu keys) and no faults (encoder counting or internal data transmission) have occurred.

This arrangement supports finding the Z-axis Home Reference Point, where the EDM Valid signal is required to allow the ram to move.

the <u>ERROR COMPENSATION</u> screen is displayed (after pressing the [ SET SYS ], < SET AXES >, entering the password, and pressing the < ERROR COMPENSATION > and [ Z ] keys and menu keys) and no faults (encoder counting or internal data transmission) have occurred. This arrangement supports setting the Z-axis error compensation, where the EDM Valid signal is required to allow the ram to move.

the TAPER CALCULATOR screen is displayed (after pressing the [ CALC ] key twice) and no faults (encoder counting or internal data transmission) have occurred.

This arrangement supports using the taper calculator function with an Edge Finder to find tapers by touching points along the workpiece. It allows use of the ram where the Retract Point signal is required for ram movement.

Spark Point outputs 1-4. Each of these normally-open contacts close under the following conditions:

- the outputs are enabled.
- the Z-axis measurement passes the boundary value for each Spark Point.

Each set of Spark Point relay contacts remain closed as long as the outputs are enabled, and no faults occur. The Spark Point outputs work in conjunction with the Z MAX (or Z MIN) measurement; individual Spark Point contact sets will also be opened if, on pressing the < RESET MAX > (or MIN) menu key, the Z absolute measurement is outside the individual Spark Point boundary value.

These signals are commonly used to change operating conditions at specific points (such as changing the burn parameters, ram speed, etc.).

If the Pulsed Output feature is set for the Z-axis, each of the Spark Point contact sets is closed for approximately one second when the ram position reaches or passes individual Spark Points, then opens again. Once individual Spark Points have been passed (closing and opening those contacts), that contact set will not operate again until the outputs have been disabled (with the menu key) and enabled again.

Settings for the Z-axis Spark Points and the Retract Point are made by using the [SET POINT] key. A complete description of Spark Point and Retract Point setting and operating procedures is given in Section 4. EDM operations.

#### Connections to the external controls

Each of these seven sets of contacts lead to pins on the 16-pin receptacle on the back panel of the CFI Module. In addition, a set of pins are provided for connecting the First-Spark Detector accessory. A mating connector is provided to allow the installer to connect EDM VISION to the EDM machine controls.

As EDM VISION is intended for use on all common EDM machines, it is not possible to give complete hook-up instructions that will apply in all cases. The installer must examine the EDM machine and its wiring diagrams closely to determine how best to connect the wiring. Some of the signals that are provided by EDM VISION may not be required for specific machines. Refer to Appendix D in Section 6. Appendices for details about the connector, relay contact current ratings, etc.

#### Connecting accessories

Connect all accessories to EDM VISION. Follow the instructions in Section 5. Accessories and in each accessories' Reference Manual.

Each accessory should be mounted so that:

- vibration, normal material handling, traffic near the installation site, and operation of the EDM machine will not damage the accessory or cause it to fall.
- power and signal cords are out of the way so they will not be damaged by normal traffic and are not a tripping hazard to the operator.
- cords provide enough length to allow normal movements of the EDM machine tables and other components.
- the accessories are within the view and easy reach of the operator.

#### CAUTION

If an Option Module has been installed, and the Edge Finder accessory is to be used, a jumper on the CPU Module must be moved. If the jumper is not set properly, the CPU or Option Module may be damaged. Refer to "Installing / removing modules" earlier in this section for instructions.

CHARLES AND RESERVED AND AND AND ADMINISTRATION OF THE SECOND PARTY ADMINISTRATION OF THE SECOND

Connect a ground wire from the terminal at the back of EDM VISION to the EDM machine. The machine should also be connected to a solid earth ground.

# Connecting ground, checking voltage, connecting power

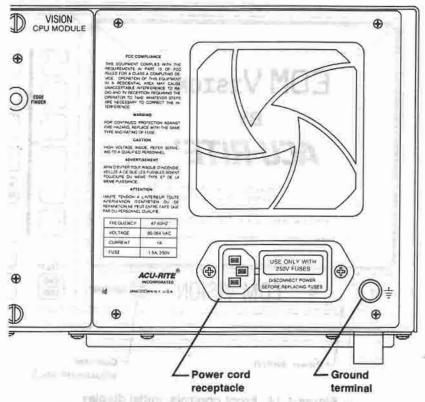


Figure 1-13. Power and ground connection locations

Confirm the voltage available at the power source for connecting to EDM VISION. Refer to Appendix B in <u>Section 6</u>. Appendices for a listing of the voltage range that is acceptable for use with EDM VISION.

#### CAUTION

Connecting EDM VISION to a power source outside of the acceptable range may damage EDM VISION or the encoders.

Connect EDM VISION to the power source using the power cord supplied.

Equity to 21 of the professional pressuring after very

#### Initial system power-up

checking vollage,

connecting power

Turn the power switch to ON. After a few seconds, an initial display will show on the CRT. If necessary, adjust the contrast knob on the front.

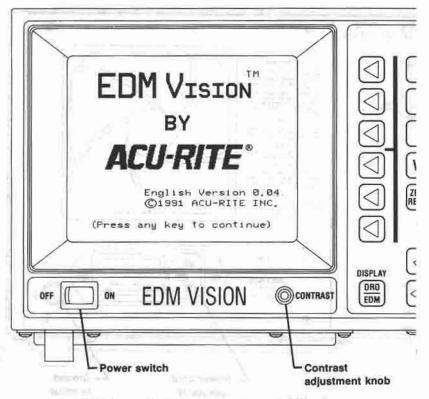


Figure 1-14. Front controls, initial display

Press any key (except [ HELP ]) to continue.

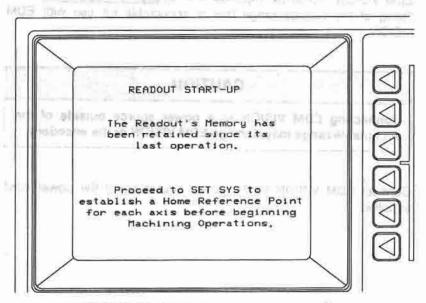


Figure 1-15. Display after pressing any key

The initial display is replaced with an informational display giving EDM VISION status information. Ignore the instructions for now, and press the [ DRO/EDM ] key.

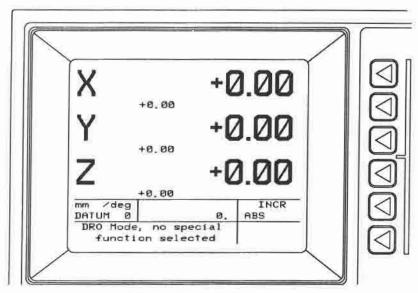


Figure 1-16. DRO display

The CRT shows the normal DRO mode display, with all parameters set to the factory default settings.

EDM VISION operation has now been verified and the system installed. EDM VISION is ready to be set up for this installation. Setup will involve setting several parameters to allow the system components to work together (such as entering the encoder resolution) as well as making operator-preference settings (such as measuring units).

Proceed to Section 2. Getting acquainted with EDM VISION features for further information on how EDM VISION features work, or to Section 3. SET SYS: EDM VISION setup operations to begin the setup operation.

# Section 2. Getting acquainted with EDM VISION features

TOTAL THE THURSDAY.

EDM VISION provides many advanced features to assist with EDM operations. This section provides an overview of the features. For more in-depth instructions, refer to Section 3. SET SYS: EDM VISION setup operations and Section 4. EDM operations.

Elding of account blink in valgety ORO ent attended. Lis mapt

The front panel controls consist of the power ON/OFF switch and the contrast adjustment knob. Both are located near the bottom left-hand side. Use the contrast adjustment knob to brighten the displayed image.

## Front panel controls

All EDM VISION measuring, setup, and status information is displayed on the CRT screen. Two main display screens are provided for normal operations: the DRO display mode, and the EDM display mode. The operator can toggle between these two displays by pressing the [DRO/EDM] key on the front panel. Many other displays are used to present functional information as it is requested.

Display information, other than the DRO and EDM basic measuring display modes, is presented in several ways. Some types of displays are full-screen functions that occupy the whole display area, temporarily displacing the measuring display. Examples of this type of display are those accessed by pressing the [SET SYS], [SET POINT], [HOLE PTRN], [CALC], and [HELP] keys. The full-screen function is cancelled and the measuring display restored by pressing the [DRO/EDM] key.

Other display information modifies the DRO or EDM displays. Examples of keys that modify measuring displays directly are the [INCH/MM] and [DEG/DMS] keys. Here, the action is immediate and changes the way the measuring information is displayed.

Measuring displays are also modified by several multi-key functions. Examples include zero resetting and presetting functions, EDGE FIND routines, and DATUM routines. The routine modifies an informational section of the display with each key press that is required, to help lead the operator through the routine.

Finally, the display is modified by a "sleeping" display, that replaces any display with a CRT-saving message. This display prevents permanent burn-in of a display, and helps prolong the life of the CRT. The previous screen is restored by pressing any key.

DRO and EDM mode measuring displays are explained below. Displays for setting parameters that control EDM VISION functions are given in Section 3. SET SYS: EDM VISION setup operations. All other displays are discussed in Section 4. EDM operations.

their position or recipitions. Zhiru in always cooper all it position

Display screen

**EDM VISION** 

with new

## DRO (digital readout) display mode

Front panel

Display sersen

controls

The DRO (digital readout) display mode provides the basic measuring information that is used for workpiece setup, and for changing the position of the workpiece (usually to start a new EDM feature). With most installations, this will be a three-axis display of the position of the workpiece, with reference to a nominal zero point on the workpiece, tool, or table. Measuring displays for up to four axes can be displayed at once; if four measurements are displayed, each display is reduced in size to fit the screen.

Figure 2-1 represents the DRO display at initial power-up, with the factory default settings in place. Note the display features. The upper two-thirds of the display is devoted to measurement displays, and the lower third presents other information.

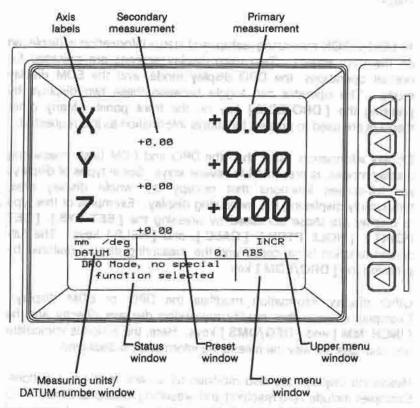


Figure 2-1. DRO display with factory default settings

#### Measurement display window

Primary measurement

Either the absolute or incremental measurement can be shown in the primary measurement display for each axis, as set by the < INCR/ABS > menu key. This may be either a linear or rotary measurement. The measuring units are denoted in the measuring units window. The maximum measurement that can be displayed depends on the type of encoder (linear or angular), encoder and display resolution settings, and on the current selection for measuring units. Display resolution (the least-significant counting digit) also depends on encoder type, encoder and display resolution settings, and on the current setting for measuring units. Measurements may be either positive or negative. Zero is always shown as a positive value.

Either the absolute or incremental measurement is shown in the secondary measurement display for each axis, as set by the < INCR/ABS > menu key. The conditions noted for the primary measurement also apply here.

Secondary measurement

Axis labels differentiate the measurements displayed. They are assigned as a part of the axis setup routine within the SET SYS parameter setting sequence. Axis labels are assigned from corresponding axis keys on the keypad: X, Y, Z, and W. The encoder installed on the vertical ram axis must be connected to the CFI module, and this axis must be labeled as Z; this allows the special motion control features provided with EDM VISION to work as they are intended.

Axis labels

Up to four measurements (and labels) can be displayed at a time, even if more than four encoders are connected to EDM VISION.

hay no the hungard. That half him much make make the other

This area of the display is reserved for other information required to interpret the measuring display. The area is divided into separate windows, each of which gives some additional information about the current measurement, or about the status of current operations.

Information windows

The measuring units are shown at the top of this window, and indicate the current selections for linear and angular measuring units. The display is presented as (linear units)/(angular units). Linear units are inches or millimeters; angular units are decimal degrees or degreesminutes-seconds (presented as 37.64° or 37° 38' 24").

Measuring units/DATUM number window

The DATUM number display at the bottom of this window indicates the current DATUM number selected. Multiple DATUMs assist with maintaining feature relationships as defined by engineering prints.

This window displays the last preset number entered. It also notes the last key pressed, for multiple-keystroke presetting sequences.

Preset window

This window shows the status of various operations that are underway. Messages appear during edge finding and DATUM operations, among others.

Status window

For the standard DRO display, this window indicates the current selection for primary and secondary measurement displays. The label at the upper right corresponds to the larger of the two measurement displays shown. The label at the lower left corresponds to the smaller measurement display. For this set of displays (after initial power-up, or after re-setting EDM VISION to factory defaults), the larger display is the incremental measurement, and corresponds to INCR shown in the window.

Upper menu window

This window also acts as a label for the corresponding menu key (the vertical row of keys to the right of the display are menu keys). For the

standard DRO display, pressing the menu key next to this label will toggle the position of the two labels in the window, and the position and size of the corresponding measurement displays.

While preforming other functions in the DRO display mode (such as presetting), the message in this window will change to allow other actions that relate to that function. For example, after pressing the X-axis key (which starts a presetting function), this menu changes to "FREEZE".

consequently parallely so the beyond X. Y. Z. and W. The engages

#### Lower menu window

Sepondary measurement

Arte Jainein

WIG BRIDE

Property leading

WINDOWS LOSSIN INCIDEN

For the standard DRO display, this window has no message. It works like the upper menu window; when an appropriate message is displayed, pressing the key immediately to the right will activate that feature.

the matery comment and broken the design to the participant of the state of

# **EDM** display mode

Information windows

Measuring units/DATUM number

The EDM display mode is accessed by pressing the [DRO/EDM] key on the keypad. The EDM display mode provides the basic measuring information that is used for EDM operations. Three separate measurements along the Z-axis are displayed. With proper setup, it also provides a graphic display of the current EDM operation.

Figure 2-2 is a representation of the EDM display under the following conditions:

- following the initial power-up or a memory reset operation.
- parameter settings for EDM display format: bar graph ON, absolute and incremental displays selected.
- spark point table settings (burn direction = +, the default value):

Table 2-1. Example spark point settings

Spark point	Position (mm)
ran faribates of the	2.5
2	5
3	7
4	9
5 (Retract)	10

These settings have been made to illustrate the display features.

As with the DRO mode display, the upper two-thirds of the EDM mode display is devoted to measurement displays, and the lower third presents other information.

the values and a second or for each law to homeworth, and the state of

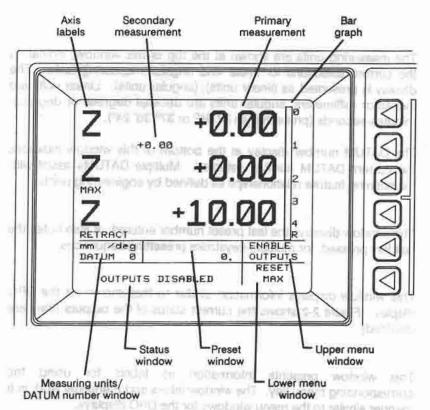


Figure 2-2. EDM display with settings as noted

This area displays three separate measurements based on the absolute Z-axis position. The top-most display, labeled Z, is the current position. The middle, Z MAX, display shows the maximum (or minimum, depending on a parameter setting) penetration of the Z-axis, regardless of the current position. The bottom-most measuring display is labeled Z RETRACT, and indicates the point at which a control signal will be sent to retract the ram.

The absolute measurement is always located in the primary measurement position. With both absolute and incremental displays selected, the incremental measurement is displayed in the secondary measurement position for the Z measurement only. The positions cannot be switched as they can be with the DRO display mode.

respective and the light to

With the bar graph enabled, a bar graph is presented along the righthand side of the EDM display. Although not shown, a filled-in bar will progress down the graph as EDM operations progress, showing the relative position of the ram (or electrode) to the retract point.

## Measurement display window

Helitarian Military (No. 1977) and the IM

#### Information windows

Measuring units/DATUM number window The measuring units are shown at the top of this window, indicating the current selections for linear and angular measuring units. The display is presented as (linear units)/(angular units). Linear units are inches or millimeters; angular units are decimal degrees or degreesminutes-seconds (presented as 37.64° or 37° 38' 24").

Phone Lincoln.

The DATUM number display at the bottom of this window indicates the current DATUM number selected. Multiple DATUMs assist with maintaining feature relationships as defined by engineering prints.

Preset window

This window displays the last preset number entered. It also notes the last key pressed, for multiple-keystroke presetting sequences.

Status window

This window displays information similar to that shown for the DRO display. Figure 2-2 shows the current status of the outputs (they are disabled).

Upper menu window

stockurement display

WIDDIW

This window presents information as labels for using the corresponding menu key. The window labels and menu key work in a manner similar to the menu windows for the DRO displays.

face/il-

Here, the menu window and menu key provides a means of enabling and disabling outputs from the CFI Module, so that EDM operations can proceed. Outputs are toggled on or off with successive presses of the menu key; and the menu label changes to show the opposite condition.

Lower menu window

This menu window works like the windows described for the DRO display mode, and the upper menu window. The menu label shown, < RESET MAX >, allows the Z MAX measurement to be reset to the current value of the Z measurement.

select of the encremental management is displayed for the succeding mass personal programment programment of the 2 mass prosess make. The portained control of the programment of the pr

Avian the part grown enableds is but stoody to presented world the first nager with crime story display. Although our Arrests is illected that safe progress displays as a stooms at the progress allowing the

mariye positive as the agm is a generoder to the estact point.

pers, required of the content position. The postumental resignative

All EDM VISION operations (other than turning the power on or off and adjusting the display brightness) are performed with the keypad. The keypad occupies the right half of EDM VISION.

Refer to Figure 2-3. The keypad is divided into functional groups of keys. A short explanation of each key's operation is given below. More-detailed explanations of each function are given in <u>Section 4</u>. EDM operations.

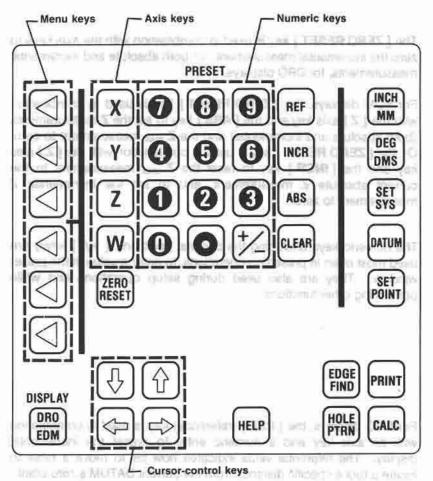


Figure 2-3. EDM VISION keypad

of the contract of the figure of the contract of the contract

Menu keys are used in combination with menu labels presented on the display. They are "context sensitive"; the action that occurs depends on the menu message.

In breaching the pheatical content to the current measurements for TCM declars the [MCF ] by it used in combinates with the (2 very 125AC RESCT 1 kings to read the 2 recombinates with the current 2 measurement, and to read the 2 recommend measurement in the increase of the Charlest Pey 12 recommend measurement in the current of the current 2 vertical transfer to the current 2 vertical transfer to the current 2 recommends of the current 3 recombinates above to the current whether the current to the current by the current beauty of the current whether the current whether the current to the current beauty that the current beauty the current beauty to the current and the current and the current whether the current current the current the current current the current current the current contents.

# Keypad













## Axis keys:



Keypad



The [X], [Y], [Z], and [W] keys are used to select an axis to operate on.

to approving testocharum each between in tempera in the late, magnetic metallianceted metallic an incidensation is and in one to transmission metallic approa- applicable in leaving any incidency doesn't, are alternated to both their until the

In Digital In Class by Stand Printer (with emographic backy by Sect.)

ZERO RESET The [ ZERO RESET ] key is used in combination with the axis keys to zero the incremental measurement, or both absolute and incremental measurements, for DRO displays.

For EDM displays, the [ZERO RESET] key is used in combination with the [Z] axis key and the [ABS] key to set the Z measurements (both absolute and incremental) and the Z MAX measurement to zero. Or, the [ZERO RESET] key is used in combination with the [Z] axis key and the [INCR] key to reset the Z MAX measurement to the current absolute Z measurement, and to set the incremental Z measurement to zero.

## Numeric keys:



The numeric keys (including the decimal point and [ +/-] keys) are used most often in presetting operations, to enter a value in the preset window. They are also used during setup operations and while performing other functions.



For DRO displays, the [ REF ] (reference) key is used in combination with an axis key and a numeric entry to preset the incremental display. The reference value indicates how far to move a table to locate a tool a specific distance from the current DATUM's zero point.



For DRO displays, the [INCR] (incremental) key is used in combination with the axis keys and the [ZERO RESET] key to reset the incremental measuring displays to zero. Or, the [INCR] key is used in combination with the axis keys to preset the incremental measuring display by the value shown in the preset window (subtracting the preset value from the current measurement).

For EDM displays, the [INCR] key is used in combination with the [Z] and [ZERO RESET] keys to reset the Z<sub>MAX</sub> measurement to the current Z measurement; and to reset the Z incremental measurement to zero. Or, the [INCR] key is used in combination with the [Z] key to reset the Z<sub>MAX</sub> measurement to the current Z measurement; and to preset the Z incremental measurement by the value shown in the preset window (subtracting the preset value from the current measurement).

Manu keys:

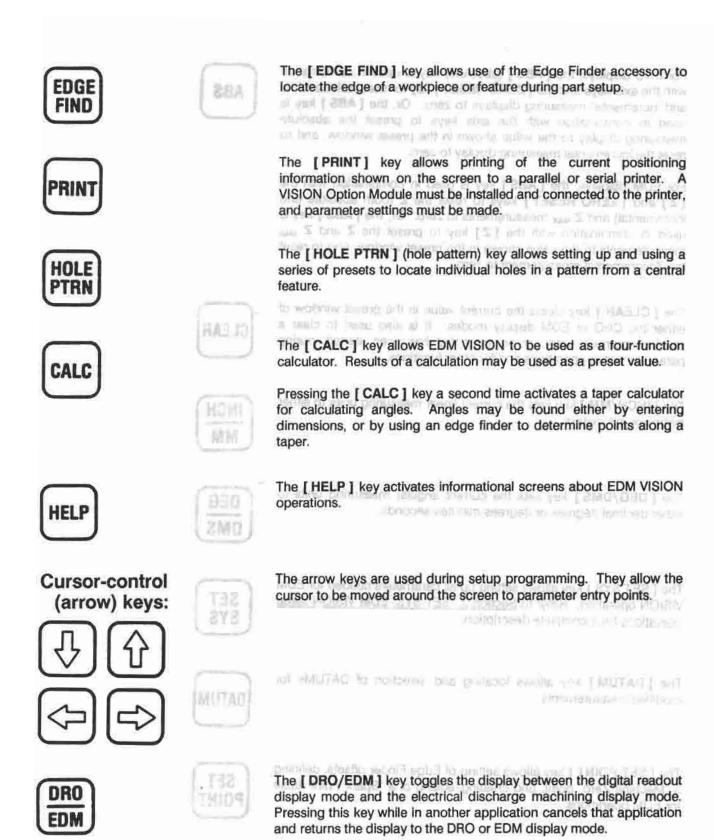
For DRO displays, the [ABS] (absolute) key is used in combination with the axis keys and the [ ZERO RESET ] key to reset both absolute ABS and incremental measuring displays to zero. Or, the [ABS] key is used in combination with the axis keys to preset the absolute measuring display to the value shown in the preset window; and to reset the incremental measuring display to zero. For EDM displays, the [ABS] key is used in combination with the [Z] and [ZERO RESET] keys to reset the Z (both absolute and incremental) and Z MAX measurements to zero. Or, the [ABS] key is used in combination with the [Z] key to preset the Z and Z MAX measurements to the value shown in the preset window; and to reset the Z incremental measurement to zero. The [CLEAR] key clears the current value in the preset window of either the DRO or EDM display modes. It is also used to clear a previous numeric entry, or an entry that has been started, during parameter setup operations and for other functions. The [INCH/MM] key sets the current linear measuring units to either inches or millimeters. The [ DEG/DMS ] key sets the current angular measuring units to either decimal degrees or degrees-minutes-seconds. longor-como The [ SET SYS ] key allows setting up all parameters needed for EDM SET VISION operation. Refer to Section 3. SET SYS: EDM VISION setup ALLOW) FOAS operations for a complete description. SYS The [DATUM] key allows locating and selection of DATUMs for modified measurements. DATUM

The [SET POINT] key allows setting of Edge Finder offsets, defining a "Machine Zero" point, and creating/editing of a "Spark Point" table for EDM operations.

and running the displaying both OPO is HDM display moon







EDM VISION has built-in display screen protection. This feature turns off the screen display after approximately 10 minutes of keypad or encoder inactivity. This action prolongs the life of the CRT by avoiding "burn-in" of the image on the display screen.

# "Sleeping" screen

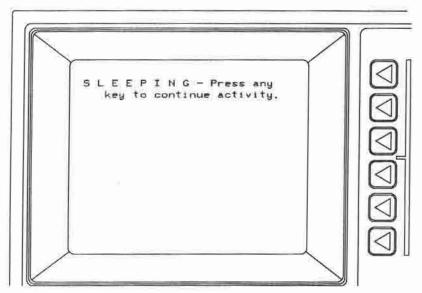


Figure 2-4. "Sleeping" screen-saver display

When no keys have been pressed or no encoder movements have been sensed for approximately 10 minutes, the current display (DRO or EDM display mode, or any other display screen) will be replaced by a "SLEEPING - Press any key to continue activity" message. The message is dimmed, and advances slowly down the screen to further prevent "burn-in".

#### **IMPORTANT**

The screen will not "sleep" while the CFI machine-control outputs are enabled. An active operation will always be shown.

The "sleep" feature is deactivated; this prevents unadvertantly leaving an operation running because the operator is unaware of the EDM operation status.

Note that Press any key to return to the screen last used. The screen will not be affected by the key used to restore the display.

This concludes the overview of EDM VISION features. Proceed to Section 3. SET SYS: EDM VISION setup operations for instructions on setting up EDM VISION for your installation, or to Section 4. EDM operations for more in-depth information about EDM VISION features.

# Section 3. SET SYS: EDM VISION setup operations

EDM VISION has many powerful functions to assist with EDM machining operations. Many of these functions require that parameters be set up to work with the equipment installed. These parameters are set by using the [SET SYS] (or SET SYStem parameters) key and subsequent menus, choosing from pre-set parameter values with menu keys or by making entries using the number keys and/or arrow (cursor movement) keys. From the measuring display (either DRO or EDM mode), press the [SET SYS] key to begin setting parameters.

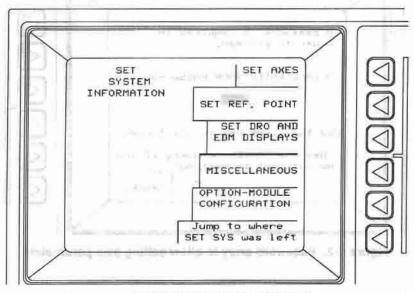


Figure 3-1. SET SYSTEM INFORMATION screen Linuxidade de antiquesto del Unidocenti Seculivi. Se incidenti.

The measuring display is replaced by a screen entitled SET SYSTEM INFORMATION. Note the row of menus along the right-hand side of the display, corresponding to menu keys. Menu keys are pressed to choose an option or to perform the function indicated by the menu Menu keys are used throughout the parameter setting block. operations.

One of the menu keys on the above display is [ OPTION MODULE CONFIGURATION ]. This menu key will only be present if an Option Module has been installed; otherwise, this area of the display is blank.

EDM VISION

Setting axis

# Setting axis parameters

Parameters must be set for each axis supported by EDM VISION, so that movements made are accurately displayed. Axis parameters include labels for each axis (which axis is to be considered the X-axis, Z-axis, etc.); selection of linear or angular measurements; resolution (or number of counting pulses per standard measurement unit); whether FTOs (Fiducial Trigger Output signals, a fixed reference point on the encoder) are available; setting of the counting direction; and error compensation (either single- or multiple-interval). Press the menu key opposite the < SET AXES > menu to begin setting axis parameters.

AVAIL DOWN DOOR OF STREET WARM TO SERVICE SAME

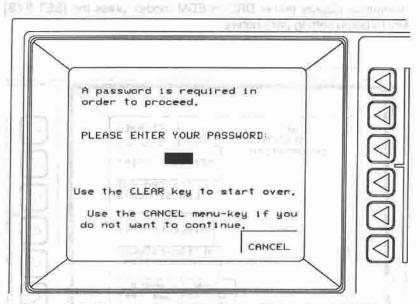


Figure 3-2. Password entry to allow setting axis parameters

# Password protection

Some parameters will be changed as EDM operations are performed, and are only used temporarily. Axis parameters are seldom changed once the system is installed, since they reflect the encoder and machine characteristics. Axis-definition parameters are protected from accidental changes by requiring a password entry. Enter the password by using the number keys. If an incorrect password entry is started, it may be cleared with the [CLEAR] key and re-entered.

ENGLOSS MINISTER Law yellowing with the recognition of the second state of the second

## **IMPORTANT**

The password is 8-8-9-1.

Supervisors may wish to remove this page after setting the parameters to prevent inadvertent resetting of the axis parameters by an inexperienced operator.

### IMPORTANT

The password is given on page 3-3 / 3-4. Your supervisor may have removed this page to prevent inadvertent changes which would affect EDM VISION performance. If this page has been removed and system changes must be made, ask your supervisor to supply the password.

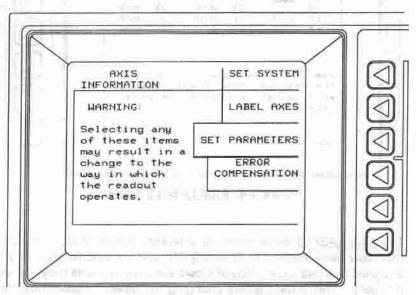


Figure 3-3. AXIS INFORMATION screen

Note that one of the menus is < SET SYSTEM >. Pressing this menu key will return to the next-higher-level screen. This feature is common to most of the parameter setting screens; and allows the operator to recover from accidently pressing a wrong key.

## Assigning axis labels

Press the [LABEL AXES] menu key to label the axes.

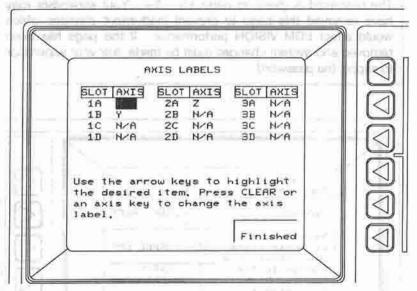


Figure 3-4. AXIS LABELS screen

The AXIS LABELS entry screen is a representation of axis modules that have been installed in EDM VISION, and the axis labels that are assigned to those axes. Default labels are assigned until they are set manually. This screen allows changing the labels to customize the display, and to choose which axes are displayed. Axes must be labeled for them to appear on the measuring display. If additional axes are added later (by adding an additional axis module and encoders), those axes must be labeled before they can be displayed.

Figure 3-5 illustrates the slot number designations for EDM VISION.

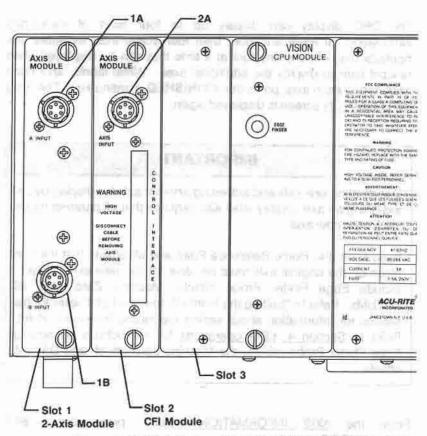


Figure 3-5. Slot designations for EDM VISION

As supplied, EDM VISION has a 2-Axis Module installed in slot 1. The upper encoder input receptacle is designated 1A and labeled X on the <a href="AXIS LABELS">AXIS LABELS</a> screen, and the lower receptacle is designated 1B and labeled Y. The CFI Module is installed in slot 2, the center slot. This single encoder input receptacle is designated 2A, and labeled Z on the <a href="AXIS LABELS">AXIS LABELS</a> screen. If additional Modules have been installed or these Modules have been moved from their original location, the labels may differ.

Axes available for labeling and display are indicated on the <u>AXIS LABELS</u> screen by an axis label (X, Y, Z, or W), or a blank field. All other inactive axis locations are indicated by <u>N/A</u>. Axis labels can be assigned automatically by performing a memory reset operation (discussed later in this section).

To manually assign labels, move the cursor (highlighted area) to one of the available axes by pressing the cursor-control keys. Press the [CLEAR] key, then one of the axis keys that has not yet been assigned. To swap labels, both axes' labels must first be cleared. The vertical axis that performs the EDM operations must be labeled as the Z-axis for EDM VISION's CFI-controlled functions to work properly. If the CFI axis is assigned a label other than Z, it will perform as a "normal" CFI axis and the special EDM VISION Z-axis

functions will not be provided. The remaining axes (usually two) may be labeled as X, Y, or W.

The DRO display can display up to four axes of measuring information. If there are more than four active axes available, the operator may choose any four at a time that can be displayed, then re-label later to display the additional axes. When labels have been assigned to each axis, press the < FINISHED > menu key. The AXIS INFORMATION screen is displayed again.

#### IMPORTANT

Deactivating one axis and activating another axis for display by reassigning an axis display label also requires that all parameters be set for the new axis.

In addition, the Home Reference Point and all offsets that were in place on the original axis must be reset for the new axis. Offsets include Edge Finder Probe offsets, Machine Zero, and all DATUMs. Refer to "Setting the Home Reference Point" later in this section for information about setting the Home Reference Point. Refer to Section 4. EDM operations for instructions on setting Edge Finder Probe offsets, the Machine Zero offset, and DATUM offsets.

# Setting axis (encoder) parameters

From the <u>AXIS INFORMATION</u> screen, press the < **SET PARAMETERS** > menu key.

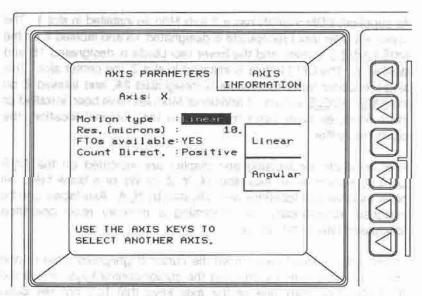


Figure 3-6. AXIS PARAMETERS screen

partorne the EDM counties.

The screen changes to an AXIS PARAMETERS screen. The current settings for the axis are shown. To select another axis, press one of

the (active) axis keys. Note that the Z-axis screen reports that the axis is equipped for EDM.

to mobility or one with almost the warmen last are heaten as a since technic

Encoder parameters are set by moving the cursor highlight over the parameter of interest with the arrow (cursor-control) keys, then using menu keys to make the setting. Parameters that can be set are type of motion, encoder resolution, availability of FTOs, and choice of counting direction. In addition, the Z-axis may be set for pulsed output.

The type of axis motion may be selected as either linear or angular. All ACU-RITE Mini-Scale and AR-5 encoders are linear encoders, and are intended for installation on linear axes. Linear axes travel in a straight line and produce a series of counting pulses.

revenillers, now if the oversion is not establic at a sumpaile

Common types of linear encoders include those based on glass scales (such as ACU-RITE encoders), reflective tape, magnetic materials, and capacitive, resistive, or inductive sensing. All of the above types of encoders share the same basic configuration: a long holder that is applied to the machine way, an encoded material, and a reading head that travels along the encoded material. All provide similar incremental linear outputs: moving the reading head one unit along the encoder produces a given number of output pulses, regardless of location along the encoder.

Linear axes may also use rack-and-pinion encoder systems; this type of system uses a rotating encoder to produce a calibrated output in linear measurements. Linear axes can also use angular encoders that are attached to rotating members such as lead screws, which are in turn attached to machine tables to produce linear motion; the output of the encoder / lead screw system is calibrated to produce a linear output. Another type of linear measuring system involves an angular encoder with a friction wheel that rides on the table or a special bar attached to the table; as with other linear systems, the encoder output is calibrated in linear units. Linear encoders are normally attached near a linear machine way or table, parallel to it, and follow the movement of the table.

Angular (or rotary) axes are rotated during use, and are coupled with an encoder to produce a series of counting pulses. The counting pulses represent an angular rotation of the machine parts. An example of an angular axis is a rotary table attached to the normal X/Y tables of a machine tool, with an angular encoder attached to determine rotational location. Note that the encoder itself may have a coarse resolution, with only a few counts per revolution. The encoder is commonly attached to the rotary table and driven through gears, so that one complete rotation of the table will require many revolutions of the encoder, producing many counts.

Select the type of axis motion by moving the highlight to the top selection, "Motion type", with the cursor-control keys and by pressing the corresponding menu key as shown in Figure 3-6.

Motion type



#### **Encoder resolution**

agu monto

Resolution for linear axes is stated as the smallest linear increment that will produce a counting pulse, such as 10um. Resolution for angular axes is stated as the number of counts per one revolution of the axis, such as 3600 counts per revolution.

printed the first and the second control of the second second second second second second second second second

The "Res." (encoder resolution) parameter must be set to match the encoder attached to the axis. For linear encoders, the resolution must be stated in microns (um, or millionths of a meter). For angular encoders, resolution must be stated in counts per one revolution (even if the encoder is not capable of a complete revolution). Note that the measuring units shown for the "Res." parameter reflect the setting for the "Motion type" parameter.

Move the highlight down to the second position from the top with the cursor-control keys. For linear encoders, use the < Finer > and < Coarser > menu keys to set the resolution parameter to match the encoder resolution. The choices shown reflect common linear encoder resolutions. Linear encoders that have an odd-increment resolution, for which there is no table setting available by using the < Finer > and < Coarser > menu keys, may be entered directly. For linear encoders with an English measuring unit, resolution must be entered as the exact calculated metric equivalent in microns. For example:

an encoder has a resolution of 0.0001". The metric equivalent is: 0.0001" x (24.5 mm/inch) x (1000 microns/mm) = 2.54 microns.

Use the [CLEAR], numeric, and [.] keys to enter the resolution for either odd-increment or English resolution linear encoders.

For angular encoders, use the < Finer > or < Coarser > menu keys to set the resolution. The choices shown reflect common angular encoder resolutions. For angular encoders that have an odd resolution, for which there is no table setting available by using the < Finer > and < Coarser > menu keys, the resolution may be entered directly. Enter the counts per revolution with the [ CLEAR ] and numeric keys. The resolution must be in integer (whole number) counts; decimals are not allowed.

#### FTOs available

This parameter accommodates encoders that have an FTO (Fiducial Trigger Output) feature. All ACU-RITE encoders are equipped with FTOs. FTOs allow use of multiple-interval error compensation and setting a Machine Zero position.

Set the appropriate response with the < YES > and < NO > menu keys.

#### Count direction

The "Count Direct." (counting direction) parameter sets the direction of increasing measurements. The counting direction may be changed by selecting the opposite sense for the parameter. Set the direction by pressing either the < **Positive** > or < **Negative** > menu key.

The Z-axis, when used in conjunction with the CFI Module, allows "latched" or "pulsed" CFI outputs. These terms refer to the characteristics of the CFI output signals for Spark Points 1-4. "Latched" signals remain **ON** once the condition for that signal is met, until the **Z** measurement is no longer within the Spark Point boundary or the outputs are disabled.

"Pulsed" outputs turn the output signals **ON** when the **Z** measurement matches the Spark Point value, then turn **OFF** again (after a short delay) when the **Z** measurement moves beyond the Spark Point setting. For example:

the ram is moving, and the absolute Z measurement is approaching the setting for one of the Spark Points. Before the Z measurement matches the Spark Point setting, the relay contacts for that Spark Point are open. When the Z measurement matches the setting, the contacts close; they will remain closed as long as the Z measurement matches the Spark Point

With "latched" outputs, the contacts for that Spark Point remains closed while the ram continues movement beyond the Spark Point setting. With "pulsed" outputs, once the ram moves beyond the Spark Point setting the contacts for that Spark Point remain closed for an additional 3 seconds, then open.

The ram reverses direction, and the absolute Z measurement again approaches the setting for the Spark Point. With "pulsed" outputs, when the setting and Z measurement again match, the contacts close again; when the Z measurement moves beyond the setting, the contacts will open again after a three-second delay. With "latched" outputs, the contacts open as soon as the Z measurement moves beyond the set value.

External controls sometimes require one or the other type of output. Check with the technician who has installed the EDM VISION system to determine the correct setting. If pulsed outputs are required, press the < YES > menu key. If latched outputs are required, press the < NO > menu key.

When finished with setting the axis parameters, return to the <u>AXIS INFORMATION</u> screen by pressing the < **AXIS INFORMATION** > menu key.

of michael pilmowith a swappin ask a nitriti. Heberopii

# Pulsed output

noit unaqme.

Machine coomainy extent

The procedure outlined below relates to using a step gage to measure errors on the X-axis table. Measurements for the other tables will use similar procedures. Using a laser measuring system as the standard is similar, but does not require a dial indicator or as complicated procedures. Laser-based measurements may be taken anywhere along the table movement; step gage measurements can only be taken where a gaging surface is available, usually at evenly-spaced intervals.

#### IMPORTANT

If the encoder on this axis has an FTO feature, ACU-RITE recommends that the Home Reference Point be set prior to beginning this procedure. Setting the Home Reference Point will zero the incremental display when the FTO feature on the encoder is sensed. This will allow direct measurements for each of the points used to determine the error compensation, and is extremely useful for determining multiple-interval compensation break point locations.

- Set up the measuring standard centered on the area of the table most often used. The standard should be at the height above the table where most of the work is performed. The gage must be aligned parallel to the table travel in two dimensions, and perpendicular to the Y-axis table travel.
- Install a dial indicator in the electrode holder, or attach it to a rigid component nearby. Move the table so that the indicator bears on the first measurement edge; subsequent movements must be in a positive direction. Set the indicator to zero, and zero reset the axis measurement on EDM VISION. Start a measurement table, entering the position indicated by the step gage setup and the position indicated by EDM VISION (both are zero).
- Move the ram or vertical axis so that the indicator is above the step gage, then advance the X-axis table so that the indicator is near the second gaging surface. Carefully lower the ram, making sure that the indicator does not touch the gage or other parts of the machine. Carefully advance the X-axis table so that the indicator bears on the second gaging surface and reads zero. Enter the step gage position and the EDM VISION measurement in the table.
- Continue to take measurements and make entries to the table all along the step gage, or at least in the area of interest.

Table 3-1 is a list of typical measurements taken using a step gage. The right-hand column is the difference between the standard measurement and the EDM VISION measurement, as:

Error = Standard measurement - EDM VISION measurement

Table 3-1. Typical error measurements

Distributed Bidds not prote

arto a m

Standard distance (inches)	distance	Error (x .001")
0.0000	0.0000	0.0000
1.0000	1.0010	-1.0000
2.0000	2.0020	-2.0000
3.0000	3.0025	-2.5000
4.0000	4.0040	-4.0000
5.0000	5.0055	-5.5000
u a namer	samina laynatal night m	Consumption of the Consumption o
6.0000		-5.5000
7.0000	The second second	-6.0000
8.0000		-6.0000
9.0000	The state of the s	-6.5000
10.0000	10.0075	-7.5000
11.0000	11.0070	-7.0000
12.0000	12.0075	-7.5000
13.0000	13.0085	-8.5000
14.0000	14.0080	-8.0000
15.0000	15.0085	-8.5000
16.0000	16.0085	-8.5000
17.0000	17.0095	-9.5000
18.0000	18.0105	-10.5000
19.0000	19.0110	-11.0000
20.0000	20.0125	-12.5000
and the same of the same of	control and and the second	A STATE OF THE PARTY OF THE PAR

#### IMPORTANT

THE THE HARM IN PARTY MANUFACTURE WAS AND ADDRESS OF THE PARTY ADDRESS OF THE PARTY ADDRESS OF THE PARTY AND ADDRESS OF THE PARTY ADDRESS OF THE PART about safeting the popular retended by the state gage

and the gripping offer made of the mathem. Excelled

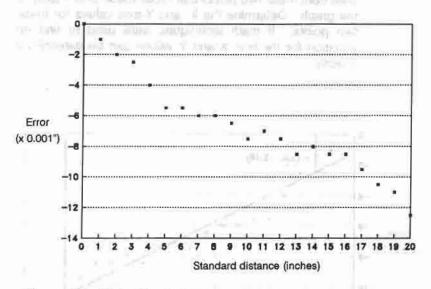
Series with miles, policy position into technicy people, from the

SITE OF ENGINEER WHEN STOP IN THE PROPERTY OF AN ALL AND THE SECTION. do not de alle al como de processor que produce de la cidar

Signs are important! Using the wrong sign can result in error correction factors that make the system less accurate than without correction.

EDM VISION

Figure 3-8 is a plot of the data from Table 3-1.



WAREST DATE AND APPLICATIONS THAT THE PROPERTY OF THE PARTY OF THE PAR

Figure 3-8. Plot of typical error measurements from Table 3-1

Construct a line through the error data, that minimizes differences from the line to all points of the graph. This can easily be done by hand, or by using one of several mathematical techniques for linear regression. The line shown in Figure 3-9 was constructed using the "method of least-squares", using all of the data points. This line approximates the errors found, and can be called a "linear", "straight-line", or "single-interval" approximation of the X-axis table error.

## Determining error compensation values

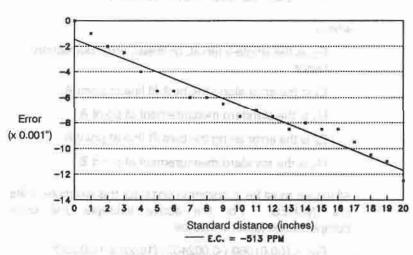


Figure 3-9. Error data with a single-interval error approximation

Select a point A on the line near the beginning, and a point B on the line near the end. Draw horizontal and vertical lines from these two points that cross the X- and Y-axes of the graph. Determine the X- and Y-axis values for these two points. If math techniques were used to find an equation for the line, X and Y values can be determined directly.

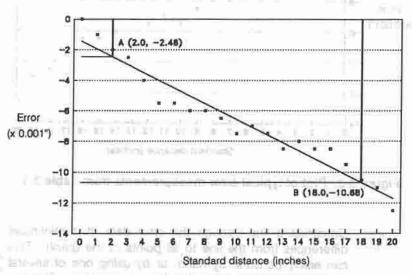


Figure 3-10. Error data with a single-interval error approximation, with selected points A and B

The "slope" or rise/fall rate of the line determines the error correction value. Calculate the error correction factor by using the formula:

continued the autor lower, and run

$$F_{EC} = ((E_B - E_A)/(M_B - M_A)) \times 1,000,000$$

where:

F<sub>EC</sub> is the single-interval, or linear, error correction factor

EA is the error along the best-fit line at point A

MA is the standard measurement at point A

E<sub>B</sub> is the error along the best-fit line at point B

M<sub>B</sub> is the standard measurement at point B

All values must be in common units; for this example, units are INCHES. For the above example, the error compensation factor would be:

 $F_{EC} = ((-0.01068-(-0.00246))/(18-2)) \times 1,000,000$ 

F<sub>EC</sub> = -513 PPM

Again, if math techniques were used to determine the line, the "slope" is given directly from the equation for the line.

The error correction factor is the slope multiplied by 1,000,000.

sine. There's and one appropriately an Property To

The above example showed the use of single-interval error compensation. In many cases multiple-interval error compensation can be used to more-closely approximate the error data, providing more accurate compensation. EDM VISION provides up to eight error compensation intervals and correction factors.

Figure 3-11 shows the same error data from the earlier example, with the previously-set single-interval factor. In addition, a multiple-interval correction is shown, using three intervals. The data is broken up into three areas, and straight-line approximations are constructed for each of the three intervals. Again, the multiple-interval lines were constructed using the "method of least-squares", but they can be accurately drawn by hand.

Single- vs. multiple-interval error compensation

Softing shape interval error

ntificentiamos

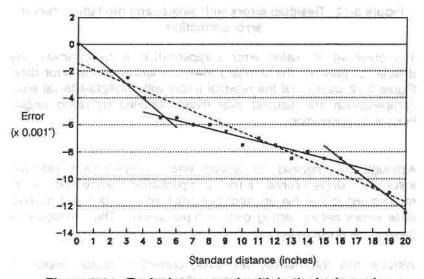


Figure 3-11. Typical error graph with both single- and multiple-interval error approximations

-bill MCLAMSCHIT gots are more to

The three intervals in Figure 3-11 were selected as X=0 to 5, 5 to 16, and 16 to 20. Notice that the difference between the error points and the multiple-interval lines in these regions in almost all cases is less than the difference between the error points and the single-interval line. This is shown graphically in Figure 3-12.

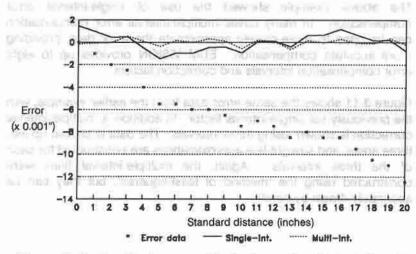


Figure 3-12. Residual errors with single- and multiple- interval error correction

The objective for using error compensation is to minimize any differences between the standard measurements and the error data. Figure 3-12 shows that the residual errors with multiple-interval error compensation are reduced over those obtained by using single-interval compensation.

## Setting single-interval error compensation

Sinote- vs. multiplis-interved

BOTTOM STANDOWNS BEACH

Although not required for setting error compensation with the automatic single-interval error compensation procedure, it is recommended that the operator construct an error plot and analyze table errors before setting error compensation. The procedure is given in the previous section.

Without this information, an error correction factor could be established that does not accurately reflect the table errors.

From the AXIS INFORMATION screen, press the < ERROR COMPENSATION > menu key. A new screen entitled AXIS to COMPENSATE is shown.

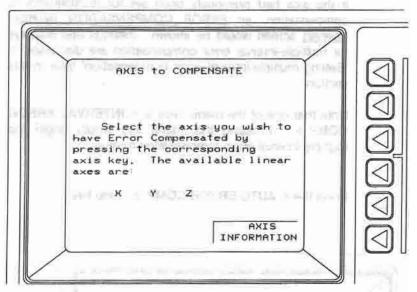


Figure 3-13. AXIS to COMPENSATE screen

Press an (active) axis key.

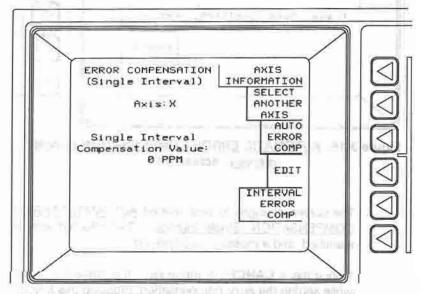


Figure 3-14. ERROR COMPENSATION (Single Interval) screen

One of two error compensation screens will be displayed, depending on the last setting made. If the last setting was a single-interval error compensation, an <a href="ERROR COMPENSATION"><u>ERROR COMPENSATION (Single Interval)</u></a> screen is shown as in Figure 3-14. This screen reports current axis selection and the current Single Interval Compensation Value in PPM (parts-per-million).

If the axis had previously been set for multiple-interval compensation, an <a href="ERROR COMPENSATION">ERROR COMPENSATION</a> (Multiple Interval) screen would be shown. Settings and displays for multiple-interval error compensation are discussed in "Setting multiple-interval error compensation" later in this section.

Note that one of the menu keys is < INTERVAL ERROR COMP >. Pressing this menu key would begin the multiple-interval error compensation routine.

Press the < AUTO ERROR COMP > menu key.

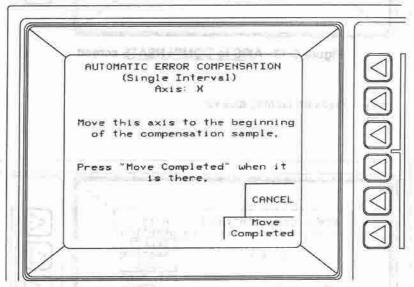


Figure 3-15. AUTOMATIC ERROR COMPENSATION (Single Interval) - screen #1

The screen changes to one entitled <u>AUTOMATIC ERROR</u> <u>COMPENSATION (Single Interval)</u>. The selected axis is identified, and a message is displayed.

Notice the < CANCEL > menu key. If a mistake is made while setting the error compensation, pressing this key will cancel the operation and return to the beginning of the routine at step 1, without making changes to the current error compensation factor.

Sew parties that will 11. Abbancarious last with no ancompany

Frage 5, 14. This parties you get a great area missible to pro-

46 Augmounted John Retaining

43

Move the table for the selected axis to the beginning of the area that is used most often. Movements along the measuring standard from this point must be positive. Set the measuring standard on the table at the height where most work is performed, and set an indicator to sense the beginning point on the measuring standard. Press the < MOVE COMPLETED > menu key.

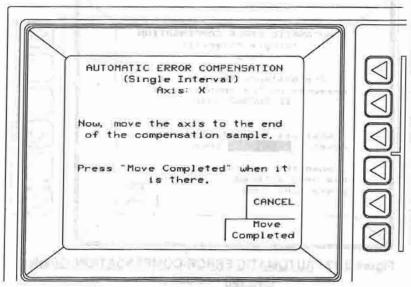


Figure 3-16. <u>AUTOMATIC ERROR COMPENSATION (Single Interval)</u> - screen #2

The <u>AUTOMATIC ERROR COMPENSATION</u> (Single Interval) screen presents a new message.

As instructed, move the table for the selected axis to near the end of the most-used area, that corresponds to a gaging point on the measuring standard. When the indicator shows that the exact gaging distance has been traveled, press the < Move Completed > menu key.

training polymers and he interesting standard

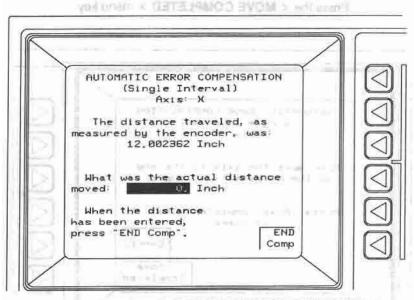


Figure 3-17. AUTOMATIC ERROR COMPENSATION (Single Interval) - screen #3

THE WAR AND MADE SHARE SOME STATISHED BY

The <u>AUTOMATIC ERROR COMPENSATION</u> (Single <u>Interval</u>) screen changes to show the movement sensed by EDM VISION, and asks for entry of the actual movement made (the distance between the starting and ending points on the measuring standard).

Use the number keys to enter the standard-based distance moved (setting of the direction of movement with the [ +/- ] key is not required). When finished, press the < END Comp > menu key.

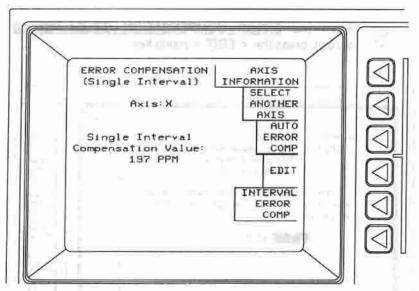


Figure 3-18. ERROR COMPENSATION (Single Interval) screen, with the above changes shown

The screen reverts to the original <u>ERROR</u> <u>COMPENSATION</u> (Single Interval) screen, showing the new setting for single-interval error compensation.

To set compensation for another axis, press the < SELECT ANOTHER AXIS > menu key. The above steps will be repeated to set the error compensation for that axis.

injulies - memory serger real

- printed by the distribute of petalane felt se

**EDM VISION** 

Mathual entry or editing of single-interval error Manual entry or editing of single-interval error compensation values Error correction factors may be manually entered or edited by using the < EDIT > menu key. Errors must first be measured, and an error compensation factor determined. Refer to the previous sections for instructions on measuring errors and determining compensation factors.

From the <u>ERROR COMPENSATION</u> (Single Interval) screen, press the < **EDIT** > menu key.

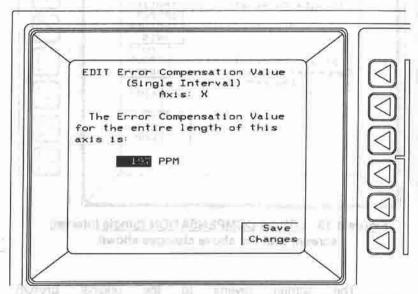


Figure 3-19. EDIT Error Compensation Value (Single Interval) screen

The screen changes to <u>EDIT Error Compensation Value</u>
(Single Interval). The selected axis and the current error correction factor are shown.

Enter the single-interval error compensation value. Use the [NUMBER], [CLEAR], and [+/-] keys to enter the error compensation value. The sign must be the same as that produced by the calculation; entering an incorrect sign will make the error twice as large as having no compensation.

Appropriate a

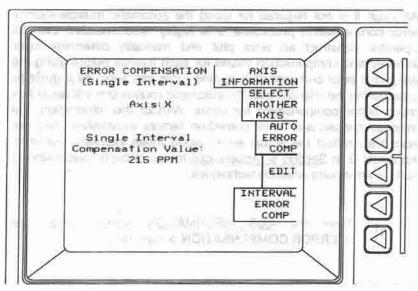


Figure 3-20. ERROR COMPENSATION (Single Interval) screen, with the above changes shown

The screen reverts to <u>ERROR COMPENSATION</u> (Single <u>Interval</u>). Changes made during the above steps are shown. In the example shown, the error compensation value was changed to 215 PPM.

EDM VISION

lavadni-skallum podjek

## Setting multiple-interval error compensation

Error compensation factors for up to eight intervals can be set either by using an automatic routine or by entering the compensation values manually.

Although it is not required for using the automatic multiple-interval error compensation procedure, it is highly recommended that the operator construct an error plot and manually determine error intervals and compensation values for each interval before using the automatic error compensation routine. This can serve as a guide to establishing the intervals with the automatic routine and will result in a much better compensation for errors. Without this information, the intervals chosen and error correction factors established may not accurately reflect the actual errors along those intervals. Refer to Appendix G in Section 6. Appendices for an in-depth discussion of various error compensation techniques.

From the AXIS INFORMATION screen, press the < ERROR COMPENSATION > menu key.

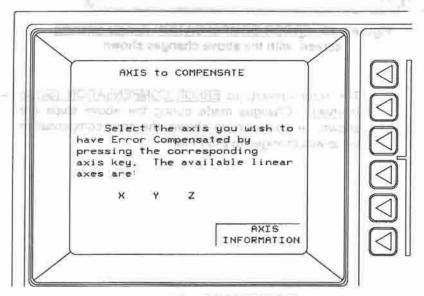


Figure 3-21. AXIS to COMPENSATE screen

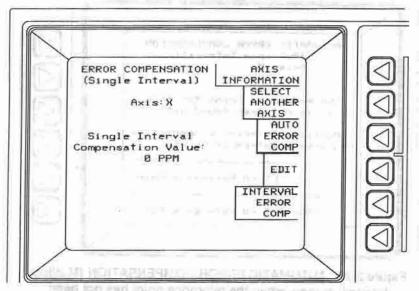


Figure 3-22. ERROR COMPENSATION (Single Interval) screen

An ERROR COMPENSATION (Single Interval) screen is shown, that reports current the axis selection and current Single Interval Compensation Value in PPM.

If the axis had previously been set for multiple-interval compensation, an ERROR COMPENSATION (Multiple Interval) screen will be shown. If this is the case, go to step 8.



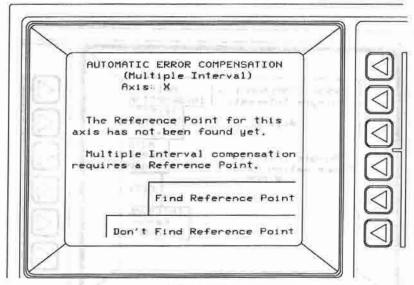


Figure 3-23. AUTOMATIC ERROR COMPENSATION (Multiple Interval) screen, when the reference point has not been previously found

Etherwiji cureum will be ablown. If they is the cases on to

The message on the screen indicates that the encoder has been identified as having FTOs available, but the Reference Point has not yet been set. The Reference Point must be set before multiple interval error compensation can be set.

Setting the Home Reference Point

A Home Reference Point must be set before setting multiple-interval error correction factors. Press the < Find Reference Point > menu key.

year with a religion wildline as writing and my bury

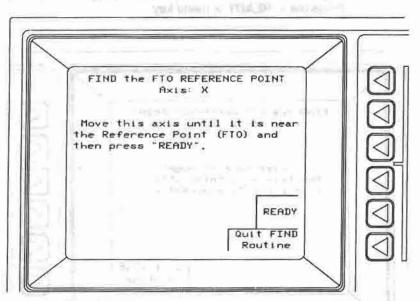


Figure 3-24. Setting the home reference point

Figure 2-24. Monning to apply the reference point

Strate Law Hold socialistics St.-E. models

Temporary State Office that any later valuable with

Reference points (Fiducial Trigger Output points, or just FTOs) are available at 200 mm (approximately 7-7/8") intervals along all ACU-RITE encoders. Determine which of these points will be used with EDM VISION, and place a marker (supplied with the encoder) on the encoder body so that the reading head is aligned with the marker when the FTO is sensed.

Move the table to a point near the FTO marker such that when the FTO point is crossed, normal measuring displays would be changing in a positive direction (becoming a larger positive number, or a smaller negative number). Press the < READY > menu key.

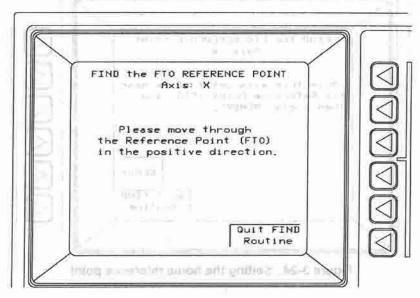


Figure 3-25. Moving through the reference point

- tim të jarroq taquië tripant blability thiaxi ionwelniti

such rabsons and no (tabsons sub-ritus owngous to-form

Move the table to pass the FTO marker and activate the FTO signal.

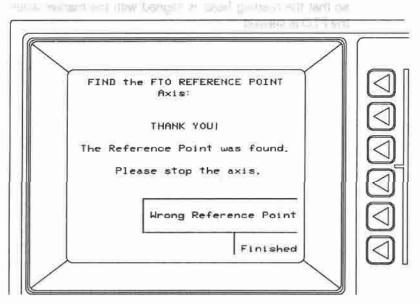


Figure 3-26. Reference point was found

The display indicates that an FTO was sensed.

If the wrong point has been sensed, press the < Wrong Reference Point > menu key, and repeat the procedure. Otherwise, press the < Finished > menu key.

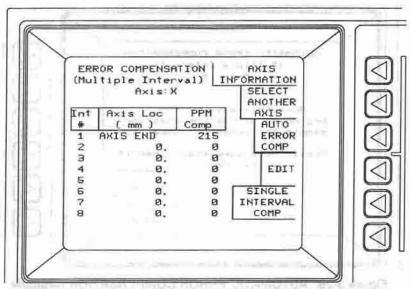


Figure 3-27. ERROR COMPENSATION (Multiple Interval)
screen

The display now shows the <u>ERROR COMPENSATION</u>
(Multiple Interval) screen. The current axis is noted, and a display shows the compensation set for up to eight intervals. If the setup procedure as outlined in this manual has been followed completely, a single-interval error compensation factor has been established, and is reported as the first interval compensation. If no compensation factor has been established yet, the first interval factor will be zero. If multiple-interval compensation had been set previously, several intervals will already be established.

Regardless of what the present screen shows, new values will be established in the following steps. Steps 8 through 16 illustrate the use of the automatic routine to set multiple-interval error correction.

The next topic, "Manual entry or editing of multiple-interval compensation values" discusses methods for direct entry of interval error correction factors with editing techniques. If an error plot has been created and intervals determined from the plot, compensation values can be entered directly using editing techniques. Steps 8 through 16 can be skipped; go directly to the next topic.

Cohologic computer of Pringletic > consultary

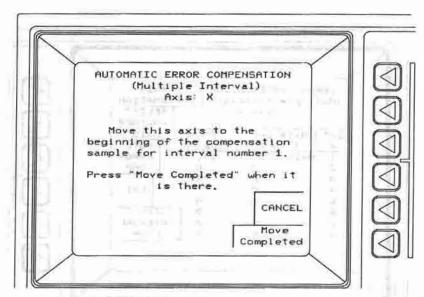


Figure 3-28. AUTOMATIC ERROR COMPENSATION (Multiple Interval) - screen #1 for the first interval

Refer to the error plot and the constructed interval compensation lines. Select a point near the beginning of the first interval line that is close to the line. Refer also to Figure 3-11 as an example. On that plot, points at 0 or 1 would be a good choice (note that starting at the plot's 0 point will not always be the best choice; the first interval line does not have to pass thru the 0 point).

Move the table to this location. Subsequent movements while setting error compensation must be in a positive direction. If movements from this point are negative, the error plot must be used in the opposite sense: start at the opposite end of the table movement, and use the last interval on the error plot as the starting point.

After moving to the starting position, establish this location as the zero point for subsequent measurements. If using a step gage, zero the indicator. If using a laser-based measurement standard, zero the laser display or note the initial measurement. Press the < Move Completed > menu key.

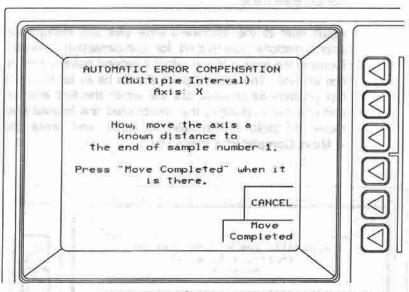


Figure 3-29. AUTOMATIC ERROR COMPENSATION (Multiple Interval) - screen #2 for the first interval

HOLD AND THE PROPERTY OF THE P

PRODUCTION OF THE PARTY OF THE

A second point must be entered to establish the first error compensation interval. Refer again to Figure 3-11 as an example. On this graph, the second point could be chosen at 4", or at 5"; both of these points show little deviation from the constructed interval error compensation line. A point at 6" would be a poorer choice; this point deviates significantly from the desired first interval compensation line.

Again refer to the machine's error plot and straight-line approximations constructed for compensation intervals. Examine the error plot and select a second point within the first interval. The second point should be as far from the first position as possible but still within the first interval, and one that is close to the constructed first interval line. Move the table to the selected point, and press the < Move Completed > menu key.

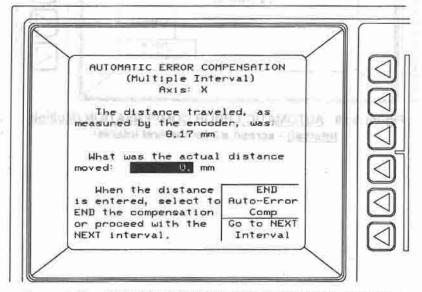


Figure 3-30. <u>AUTOMATIC ERROR COMPENSATION (Multiple Interval)</u> - screen #3 for the first interval

The display indicates the movement sensed by EDM VISION without compensation, in moving between the first and second points. Use the number and [·] keys to enter the actual movement, based on the measurement standard. Press the < Go to NEXT Interval > menu key.

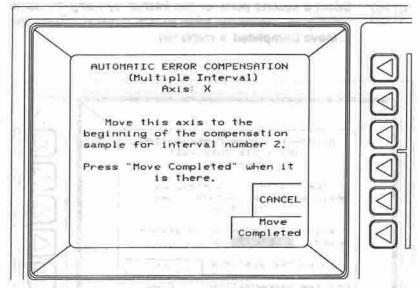


Figure 3-31. <u>AUTOMATIC ERROR COMPENSATION (Multiple Interval)</u> - screen #1 for the second interval

Again refer to the error plot and interval compensation lines. Select a point within and near the beginning of the next interval, that lies close to the second interval line. Move the table to this point, and zero the indicator or laser display or note the current standard-based measurement. Press the < Move Completed > menu key.

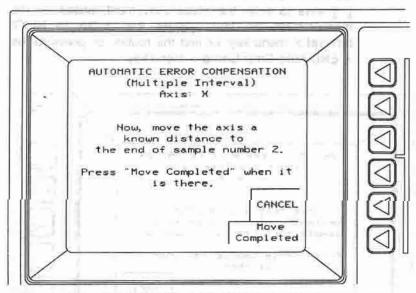


Figure 3-32. AUTOMATIC ERROR COMPENSATION (Multiple Interval) - screen #2 for the second interval

Select a second point for this interval by using the same techniques. Move the table to this position. Press the < Move Completed > menu key.

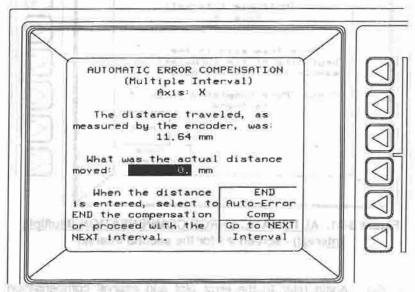


Figure 3-33. <u>AUTOMATIC ERROR COMPENSATION (Multiple</u> Interval) - screen #3 for the second interval

Move the talks to this point, and used the indicard of

The display indicates the movement sensed by EDM VISION without compensation, in moving from the first to the second point within this interval. Use the number and [·] keys to enter the actual movement, based on the measurement standard. Press the < Go to NEXT Interval > menu key, or end the routine by pressing the < END Auto-Error Comp > menu key.

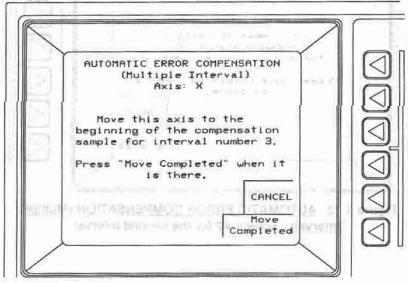


Figure 3-34. <u>AUTOMATIC ERROR COMPENSATION (Multiple</u> Interval) - screen #1 for the third interval

Repeat steps 12-14 until finishing with the last interval. If the < Go to NEXT Interval > menu key was inadvertently pressed after the last interval, press the < CANCEL > menu key at the movement instruction display. After finishing with the last interval, press the < END Auto-Error Comp > menu key.

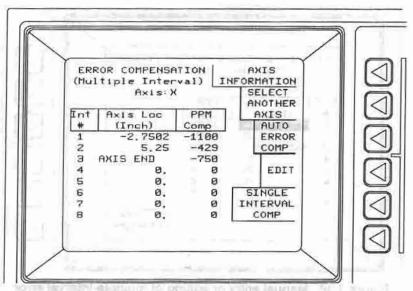


Figure 3-35. Multiple-interval error compensation table display

The screen displays a table of the error compensation values that have been established, and their end points for those compensation values. As a final check, these compensation values and end points should be plotted over the original error data and manually-constructed interval compensation lines. The lines added based on the compensation values and end points should lie very close to the manually-constructed ones, and should not allow significant differences in residual error (the difference between individual error points and the compensation lines).

If necessary, the values in the table can be edited by following the instructions given in the next topic. If finished with error compensation press the < SELECT ANOTHER AXIS > menu key to set compensation for another axis, the < AXIS INFORMATION > menu key to continue with setting parameters, or the [ DRO/EDM ] key to return to normal operation.

[ ... [ See a recovery of EAGLO ] that will be that with a long of the orthogonal control of the control of the

to produce to yours lambers

### Manual entry or editing of multiple-interval error compensation values

Multiple-interval error compensation values may be established manually, or changed, by using the EDIT feature. An error graph must have been established, and error compensation factors and change points determined before using the EDIT feature.

From the <u>ERROR COMPENSATION (Multiple Interval)</u> screen, press the < **EDIT** > menu key.

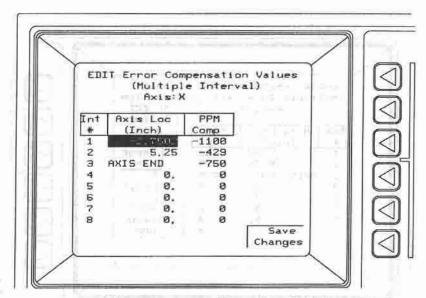


Figure 3-36. Manual entry or editing of multiple-interval error compensation values

If no error compensation has been set previously, the display shows a zero compensation entry for all intervals, and labels the "Axis Loc" (Axis Location, the interval-ending point) as "AXIS END".

The first line in the table corresponds to the first interval. Note that the point shown in the "Axis Loc" column is the most-negative point on the table. All "Axis Loc" entries are referenced to the Home Reference Point. The "Axis Loc" entries for subsequent intervals are consecutively more positive, and the last line shows "AXIS END" in the "Axis Loc" column. The first interval error compensation factor is applied to all movements from the extreme beginning of table movement allowed, ending at the point indicated by the "Axis Loc" entry for interval #1. Note that the extreme beginning of table movement is commonly prior to the first point used to establish the first interval.

All intervals end at the points shown in the "Axis Loc" column, and the next interval begins. These points correspond to intersections of subsequent interval error compensation lines from the graphed error data. The last interval ends at the extreme end of table movement; the extreme end is commonly beyond the last point used to establish the last interval.

Change or make additional entries to the table for axis location or compensation factor by moving the cursor over the current entry with the cursor-control keys, then using the [CLEAR], number, and [.]

keys. The first axis location entry must be the most-negative position in the table; subsequent axis location entries must be increasingly positive.

The entries should reflect the error compensation values determined by examining the error graph. If using eight intervals, set the first "Axis Loc" point for the location of the point where the first and second interval lines intersect on the graph; this is the ending point for the first interval. All "Axis Loc" locations must be referenced to the Home Reference Point. Set the compensation factor for that interval. Proceed to set all subsequent intervals in a similar manner. Note that movements prior to the first "Axis Loc" will have the first error compensation applied; movements beyond the last point will have the last error compensation applied. If adding an additional interval with manual entry techniques, note that the "AXIS END" label will be cleared and written over as an entry is made. Press the < Save Changes > menu key. The last entry has changed from the point entered to "AXIS END".

If using six or fewer intervals, recommended practice is to set the first and last interval for zero compensation. This will avoid adding compensation that can make measurements beyond the area of interest more inaccurate. In this case, the first point entered in the "Axis Loc" column should correspond to the first point used for setting compensation, and the "PPM Comp" value should be zero. Then, enter the remaining interval ending points and the compensation factors for each. Press the < Save Changes > menu key. Note that a final line has been added, with an "Axis Loc" entry of "AXIS END" and a compensation factor of zero.

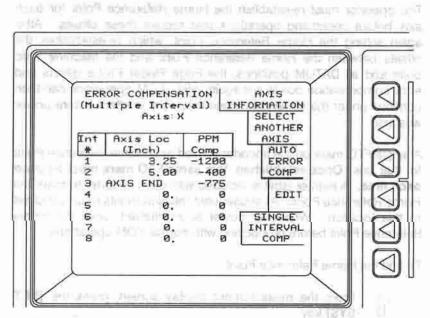


Figure 3-37. Multiple-interval error compensation table after making changes

EDM VISION

Setting the Hame

Reference Point

### Setting the Home Reference Point

ACU-RITE linear encoders include reference marks (Fiducial Trigger Output marks, or FTOs) along their lengths. They can be used to establish an external or "home" reference for the EDM machine. This allows use of several internal offsets including a Machine Zero position, DATUM positions, Edge Finder offsets, and interval error correction factors. FTO marks are spaced at 200 mm (7.87") intervals along the length of the encoder. The first is randomly located, and may be from 0 to 7.87" from the end of the encoder.

If power is interrupted or EDM VISION is turned OFF, current positioning information is lost. All axes' measurements are reset to zero when power is re-established, and the current DATUM will be DATUM 0. Even though DATUM 0 would be indicated as currently active, it would be referenced to the current (zero) location, not to the Home Reference Point; it would not be at the same location as before power was lost. All other workpiece offsets (including Edge Finder offsets and all other DATUM offsets) are referenced from DATUM 0. Since the Home Reference Point has not been relocated (which would reset DATUM 0 to the previous workpiece zero point), all other workpiece offsets are not referenced to their intended locations.

The Home Reference Points are also used to establish multipleinterval error corrections on each axis; each interval end point is referenced to the Home Reference Point. If the Home Reference Points are not re-established, EDM VISION will apply the first interval error correction factor across the entire table on each axis; this can lead to very significant inaccuracies in EDM operations.

The operator must re-establish the Home Reference Point for each axis before continuing operations that require these offsets. After again setting the Home Reference Point, which re-establishes the offsets between the Home Reference Point and the Machine Zero point and all DATUM positions, the Edge Finder Probe offsets and error compensation points are again valid. EDM operations can then continue under the same conditions that were in effect before power was lost.

A single FTO mark on the encoder is used as a Home Reference Point for that axis. Once established, this same FTO mark must be used each time. A marker label is included with each encoder to mark the Home Reference Point. All subsequent measurements retain an offset to this location. Whenever power is interrupted, scan the Home Reference Point before proceeding with normal EDM operations.

To find the Home Reference Point:

From the measurement display screen, press the [SET SYS] key.

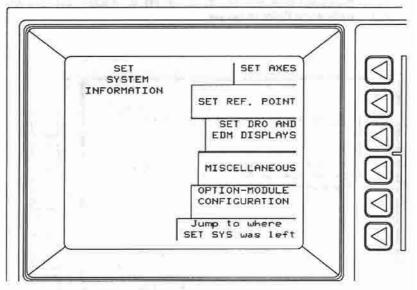


Figure 3-38. SET SYSTEM INFORMATION screen

Press the < SET REF. POINT > menu key.

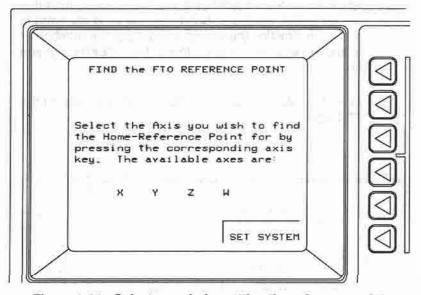


Figure 3-39. Select an axis for setting the reference point

Only axes which parameter settings indicated have FTOs are listed as available for setting Home Reference Points.

Press an axis key (X, Y, Z, or W) to enable the Home Reference Point to be set.

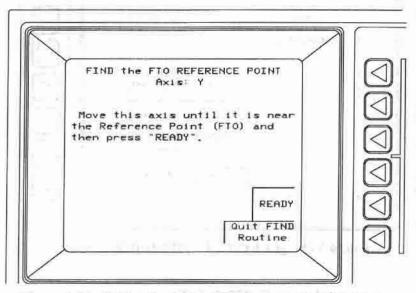


Figure 3-40. Setting the home reference point for the X-axis

- Move the table to a point near the FTO marker, such that when the FTO point is crossed, the display is changing in a positive direction (becoming a larger positive number, or a smaller negative number). Press the < READY > menu key.
- Move the table to pass the FTO marker and activate the FTO signal.

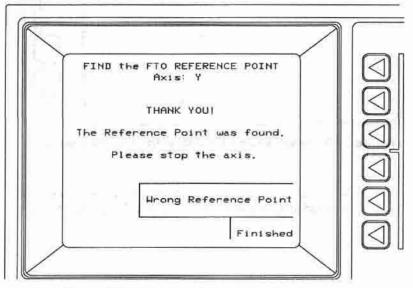


Figure 3-41. X-axis reference point was found

If the wrong point has been sensed, press the < Wrong Reference Point > menu key, and repeat the procedure. Otherwise, press the < Finished > menu key.

ment if MCGES MCE and date locate but agentic factor as if

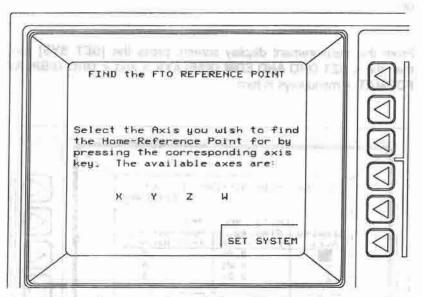


Figure 3-42. Select another axis for setting the reference point

- If not already marked, install the FTO marker label (supplied with each encoder) so that the edge of the reading head is aligned with the marker when the FTO is sensed. Or, scribe lines on the table and carriage that correspond to the FTO sensing position.
- Repeat steps 1-7 for each axis that requires a Home Reference Point.

to a stable from Phillip 16 (SPEU) bec [P] 1 draw and

**EDM VISION** 

Selling DRO and

**EDM** displays

netting yedguels Office

## Setting DRO and EDM displays

Several parameters can be set that determine the information shown on DRO and EDM displays. These include settings that an operator will want to change periodically while performing EDM operations, as well as default settings that appear each time EDM VISION is turned on.

### **DRO** display format

From the measurement display screen, press the [SET SYS] key, then the < SET DRO AND EDM DISPLAYS > and < DRO DISPLAY FORMAT > menu keys in turn.

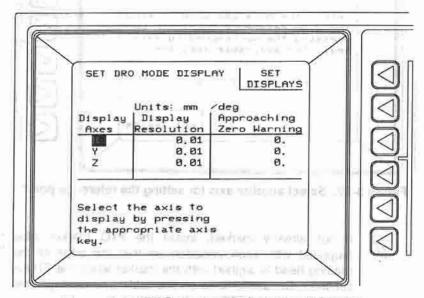


Figure 3-43. DRO display mode parameter entry

a summer part roof in

This screen allows setting the axes to be displayed, the location on the screen for the display, the resolution for the display, and a dimension for the zero warning feature.

Move the highlight around the screen to select settings. Use the axis keys; number, [ · ], and [CLEAR] keys; and the active menu keys to make settings.

tor display mezaturements

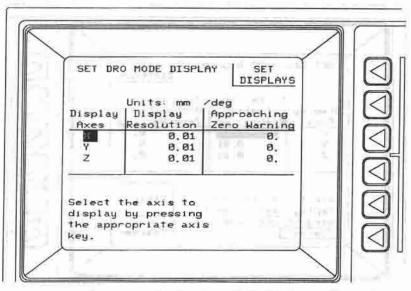


Figure 3-44. Setting the position of axes on the DRO display

Up to four axes of information can be shown on the DRO display. Select the axis to be displayed in the relative vertical position on the screen by positioning the highlight to one of four vertical positions, then pressing an axis key. Press the [CLEAR] key to remove a display.

array the fifth vittis I four properties bey couples or family

the of some police. I make it above so it and integral in a data re-

257MCD = 547% \* LUIS #9997MOS = L physics with the contract of the contract of

provide your printing of the front formy appears for orthan least you, with a

the man it is postable to see that the recommendate their the the beautiful the secretary will be

Display Resolution: setting the least-significant-digit for display measurements Move the highlight to the "Display Resolution" column.

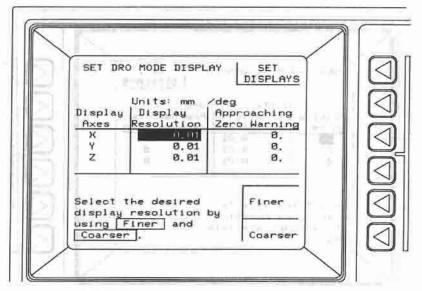


Figure 3-45. Setting the display resolution

Both the number of digits to the right of the decimal point and the rounding least-significant-digit (LSD) can be set for each axis' measuring display. Choose from available settings with the < Finer > and < Coarser > menu keys.

Note that the linear units for the display resolution on linear axes are set by the [INCH/MM] key; pressing this key toggles the "Units:" setting (above the DRO mode settings table) between "Inch" and "mm". The listings in the "Display Resolution" column of the table change accordingly. This Indicates both the "common-mode" display unit and the "mixed-mode" normally-accepted equivalent unit to be used for displays; all displays will round to these settings. "Common-mode" refers to displays in metric measuring units for metric-based encoders or English measuring units (inches) for English-based encoders. "Mixed-mode" refers to English measuring unit displays for metric-based encoders or metric measuring unit displays for English-based encoders. Since all standard ACU-RITE linear encoders are metric-based, most operations will be done with "mixed-mode" displays.

If an axis is an angular axis, the display resolution setting refers to the display in decimal degrees (the DEG units setting) only. The [ DEG/DMS ] key is inactive. DMS displays are always shown to full precision as XX<sup>O</sup> XX' XX'': two digits each for degrees, minutes, and seconds; seconds are rounded to the nearest second.

Display resolution settings are commonly made to allow a coarser display during roughing operations. The display resolution is commonly reset to the full encoder resolution for finishing operations.

Note that it is possible to set display resolution finer than the resolution of the encoders. This is not recommended; there will be

no increase in accuracy or resolution, and the display increments tend to be confusing.

Microsoft 1071 - New Investment Budglershift Investment

The display operates slightly differently in "common-mode" and "mixed-mode" operation. For common-mode operation, the display will round to the LSD chosen. If the display resolution setting is coarser than the encoder resolution, displays round to the chosen display increment. If the display resolution setting is finer than the encoder resolution, extra zeros will appear beyond the smallest counting digit. Displays will always be multiples of the encoder resolution. For example:

### Common-mode displays

awaringth waters broth

## Natural display resolution (encoder and display resolution the same):

With an encoder resolution of 0.010 mm (10um), and a display resolution of 0.01 mm, consecutive displays will be (in mm):

0.01

0.02

0.03, etc.

Each display increment is produced by one counting increment from the encoder.

### Coarser display resolution:

With an encoder resolution of 0.010 mm (10um), and a display resolution of 0.1 mm, consecutive displays will be (in mm):

0.1 The property of the contract of the contra

is an a right 0.2 or our more plifted in face or my spellants

0.3, etc.

Each display increment is produced by 10 counting increments from the encoder.

## © Finer display resolution:

With an encoder resolution of 0.010 mm (10um), and a display resolution of 0.001 mm, consecutive displays will be (in mm):

0.010

0.020

0.030, etc.

Each display increment is produced by one counting increment from the encoder, the same as shown in the first example. This display merely adds one extra zero to the right of the counting digit. No extra resolution or accuracy is provided, although finer resolution is implied from the display. Although this type of setting does not necessarily cause a problem with "common-mode" displays, this is not recommended.

being on a common trade a light of the shield

### Mixed-mode displays

For mixed-mode operation, the display will round to the closest value for the LSD chosen for the display resolution, regardless of the normally-accepted equivalent unit. For example:

For 0.010 mm (10um) encoders, the corresponding English increment would be (0.010 mm) / (25.4 mm/inch) = 0.0003937007...". EDM VISION carries the calculation out to 10 digit precision, even though displays can only show a maximum of eight digits. The normally-accepted equivalent unit is 0.0005" for display purposes.

### Normally-accepted equivalent units:

With an encoder resolution of 0.010 mm (10um), and a display resolution of 0.0005", consecutive displays will be (in inches):

is the equipme 0.0005 there are 10.0 to make some Values is 0.0010 0.0015, etc.

villagility

The first display increment is produced by the first counting increment from the encoder (0.0003937007.... x 1 = 0.0003937007....; rounded to the closest 0.0005", = 0.0005"). The second display increment is produced by the second counting increment from the encoder (0.0003937007.... x 2 = 0.0007874015....; rounded to the closest 0.0005", = 0.0010"). However, the third counting increment from the encoder produces the same display increment (0.0003937007.... x 3 = 0.0011811023....; rounded to the closest 0.0005", = 0.0010").

Normally-accepted rounding increment, mixed-mode displays are typically slightly less accurate than commonmode displays because of this rounding. Some counting increments do not produce a change in the measurement. However, this type of display is much easier to interpret since only one digit (the LSD) changes when the display shows the next increment. The maximum error introduced by this feature is less than one-half of the normallyaccepted rounding increment, or less than 0.00025" for this example.

#### Coarser display resolution: (0)

With an encoder resolution of 0.010 mm (10um), and a display resolution of 0.001", consecutive displays will be (in inches):

ad number 0.000 men pel et person sed equit transport 0.001 0.002, etc.

> The first display is produced by the first counting increment from the encoder (0.0003937007.... x 1 = 0.0003937007....; rounded to the closest 0.001", = 0.000"). The second counting increment produces the first display increment (0.0003937007.... x 2 = 0.0007874015....; rounded to the closest 0.001", = 0.001").

counting increment results in the same display  $(0.0003937007.... \times 3 = 0011811023....;$  rounded to the closest 0.001", = 0.001").

Choosing this display increment results in only half as many display changes as with example A. This can speed setups that do not require full precision, as there are two encoder counts that can match the desired position.

### Finer display resolution:

With an encoder resolution of 0.010 mm (10um), and a display resolution of 0.00001", consecutive displays will be (in inches):

0.00039 0.00079 0.00118, etc.

The first display increment is produced by the first counting increment from the encoder  $(0.0003937007.... \times 1 = 0.0003937007....;$  rounded to the closest 0.00001", = 0.00039"). The second display increment is produced by the second counting increment from the encoder  $(0.0003937007.... \times 2 = 0.0007874015....;$  rounded to the closest 0.00001", = 0.00079"). The third display increment is produced by the third counting increment from the encoder  $(0.0003937007.... \times 3 = 0.0011811023....;$  rounded to the closest 0.00001", = 0.000118").

This approach produces extremely confusing displays, since more than one digit is changing for each counting increment. This tends to be very difficult for the operator to interpret while moving the machine tables, and is extremely difficult for the operator to stop at the "correct" location, since not all numbers in the sequence are displayed (the operator could not, for example, position the table at 0.0010"). For these reasons, mixed-mode display settings for finer resolution than the normally-accepted equivalent increment are not recommended. This type of setting is, however, slightly more accurate than using the normally-accepted equivalent unit for the display increment, since each encoder counting increment causes a change to the measuring display.

Move the highlight up and down within the "Display Resolution" column with the cursor-control keys, and set the display resolution for each axis by pressing the < Finer > and < Coarser > menu keys.

## EDM VISION

Archicologia Zara Warning

and notenerate a printing

Approaching Zero Warning: setting a dimension for the flashing display warning Move the highlight to the "Approaching Zero Warning" column.

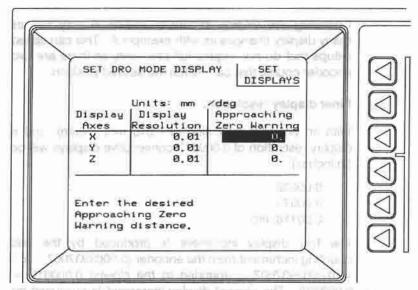


Figure 3-46. Setting the "Approaching Zero Warning" dimension

A dimension entered here sets a limit for the start of the "Approaching Zero" warning. Whenever the incremental measurement shown on the DRO display becomes smaller than this value, either positive or negative, the axis label on the display will flash. The axis label continues to flash until the measurement is again larger than the warning value, or has passed zero.

Position the highlight within the column, corresponding to an axis to be displayed. Enter a dimension using the [CLEAR], number, and [·] keys.

accepted equivalent to sense resultation them on antication accepted equivalent local entertaint are not sense accupied to bowere aliquity areas accupied at the local action according to the local according to the local according according to the local according to the local

Account and a second second of the second of the second of the second of the second se

From the measurement display screen, press the [SET SYS] key, then the < SET DRO AND EDM DISPLAYS > and < EDM DISPLAY FORMAT > menu keys in turn.

### **EDM** display format

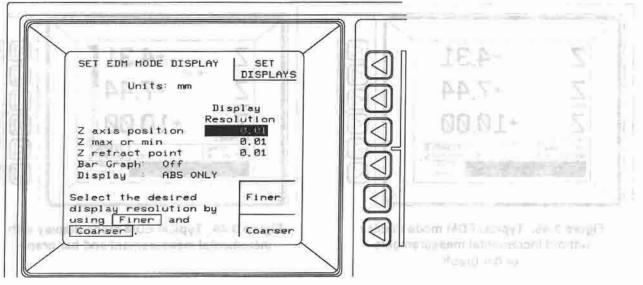


Figure 3-47. EDM display mode parameter entry

profess decreased their appointment because with

The EDM mode display consists of two or three different measurements based on the same, Z-axis encoder, and a display of the current Retract Point setting. The displays represent the current absolute position, the current incremental position (if a setting has been made to enable this feature), the max (or min) absolute position achieved, and the retract point (where a CFI signal will cause the external circuitry to retract the ram).

This screen allows setting the display resolution for each measurement; allows the display of a bar graph representing the current position and the location of Spark Points and the Retract Point; and allows displays of both absolute and incremental measurements or only absolute measurements.

Note that the Z MAX (or min) and Z RETRACT displays show only a single measurement, for the absolute measurement. Selecting < ABS & INCR > allows an incremental measurement for the top-most (Z, the current position) measurement only. The current incremental measurement is displayed in the secondary display position (to the left of, and below, the primary display position. The secondary display is also smaller than the primary display). Also note that the incremental and absolute current position measurements cannot be switched between the primary and secondary display positions as they can with the DRO display mode.

Move the highlight up or down the screen to select settings. Use the menu keys shown to make settings: < Finer > or < Coarser > for display resolution settings (similar to setting the DRO mode display resolution); < On > or < Off > for the bar graph; and < ABS ONLY > or < ABS & INCR > for the type of display.

EDM display formal

Figure 3-48 shows a typical EDM mode display without the incremental measurement and without the bar graph. Figure 3-49 shows a typical EDM mode display with both of these features.

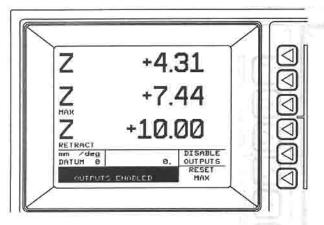


Figure 3-48. Typical EDM mode display without incremental measurements or bar graph

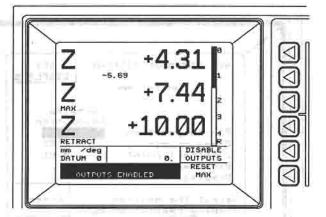


Figure 3-49. Typical EDM mode display with incremental measurement and bar graph

### Miscellaneous

Two additional functions are provided; resetting all memory to the factory default conditions, and internal testing. From the measurement display screen, press the [SET SYS] key, then the < MISCELLANEOUS > menu key.

The discourse outerwaver the attraver

Figure 5-47 Ethil directly mode parameter term

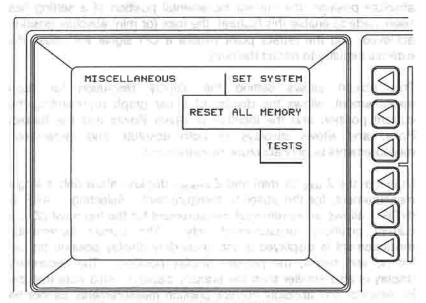


Figure 3-50. MISCELLANEOUS screen

Resetting memory

**EDM VISION** 

Press the < RESET ALL MEMORY > menu key. A second screen requires entry of the password (the password was presented at the beginning of this section), as a protection against inadvertently resetting current settings. Two additional confirmation screens are provided, as further protection. After the final confirmation, EDM VISION resets all current settings to the factory defaults, and reverts

to the opening screen. Refer to Appendix F in Section 6. Appendices for a listing of the factory defaults.

### CAUTION

Resetting all memory will reset all parameter settings to the factory default values. Current absolute and incremental measurements will be reset to zero. All settings (such as DATUM offsets, Spark Points, etc.) will be set to zero or reset.

Several internal tests are available to assist with troubleshooting suspected problems with EDM VISION. At the <u>MISCELLANEOUS</u> screen, press the < TESTS > menu key.

Tests

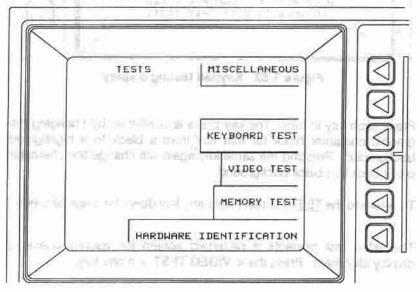


Figure 3-51. TESTS screen

**EDM VISION** 

STRUCTURE IN

### Keypad tests

A keypad test is provided to affirm that all keys are operating properly.

Press the < KEYPAD TEST > menu key.

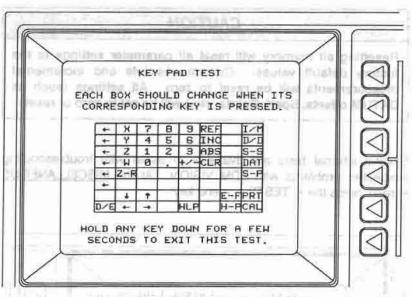


Figure 3-52. Keypad testing display

Press each key in turn. The key press is confirmed by changing the graphic character block for that key from a black to a highlighted background. Pressing the same key again will change the character block back to a black background.

To return to the <u>TESTS</u> screen, hold any key down for a few seconds.

Video tests

The video test presents a patterned screen for visually checking display alignment. Press the < VIDEO TEST > menu key.

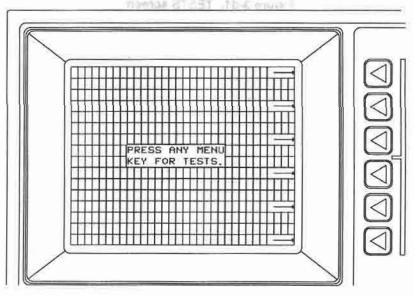


Figure 3-53. Video testing display

Check that the pattern is centered on the display area. Check that the arrows along the right-hand side are aligned with the menu keys, and that the pattern fills the whole screen. When satisfied, press any menu key to return to the <u>TESTS</u> screen.

If not problems are apparent, the RAM memory test registra and and time \$15353.

Memory tests are provided to confirm that all RAM (Random Access Memory) and ROM (Read-Only Memory) integrated circuit chips are functioning properly. Press the < MEMORY TEST > menu key.

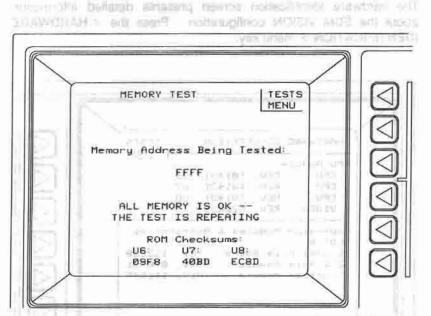


Figure 3-54. Memory testing display, after testing cycle has been completed

The <u>MEMORY TEST</u> screen initially has blanks for the "ROM Checksums:" display at the bottom of the screen, and for the "Memory Address Being Tested:" display in the middle of the screen.

tions OPU (Central Processed Unit) ROMS and this video chid

Figure 3-35. HARDWARE DESCRIPTION WEIGHT

The three ROMs contain the software instructions that allow EDM VISION to perform all of its functions. Testing of the ROMs starts immediately. When completed, checksum values are reported for each ROM. If a problem with the ROMs is suspected because EDM VISION functions are not performing correctly, contact the ACU-RITE Service Center at (800) 632-3222. They can verify the correct checksums for EDM VISION.

outh authorized executive. This filestration shows too will more it are

When ROM testing is completed, RAM testing begins. The "Memory Address Being Tested:" area of the screen displays the hexidecimal address of a RAM memory location. The addresses proceed to increment through FFFF, the last address. When all locations have been tested, a message, "ALL MEMORY IS OK -- THE TEST IS REPEATING" is displayed.

Memory tests

Hardwore utantilleation

Testing ROM memory chips

Testing RAM memory chips

Problems with the RAM memory will be reported as "BAD MEMORY, LOCATION XXXX, U\*", where XXXX denotes the hexidecimal address that was found to be bad and \* indicates the RAM I.C. designation.

If no problems are apparent, the RAM memory test repeats and continues until memory testing is stopped by pressing the < TESTS MENU > menu key.

merced \$1637 orthor mater of your proper

#### Hardware identification

The hardware identification screen presents detailed information about the EDM VISION configuration. Press the < HARDWARE IDENTIFICATION > menu key.

ELECTRONISC DESCRIPTION OF MEMORY PERFORMANCE OF STREET OF STREET, SAME

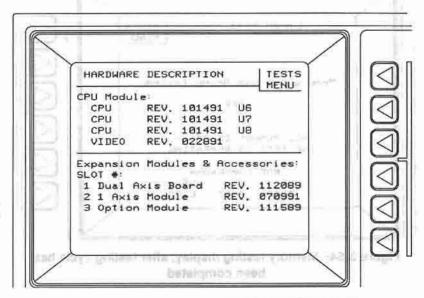


Figure 3-55. HARDWARE DESCRIPTION screen

The upper portion of the display reports revision information for the three CPU (Central Processor Unit) ROMS and the video chip, all contained on the CPU module. The revision code is the date for that revision. This illustration is only an example; your EDM VISION will likely have different revision information for each of the installed Modules.

The lower portion of the display reports on the modules installed in EDM VISION. The revision codes are the dates for the revisions of each individual module. This illustration shows the addition of an Option Module, and the revision information that pertain to that unit.

The ACU-RITE VISION Option Module is an accessory module that may be purchased separately and installed into EDM VISION. Install the Option Module according to the instructions in <u>Section 1. Installation</u>. Once installed, parameters must be set for the module to work with other equipment.

# Option module configuration

From the measuring display, press the [SET SYS] key, then the < OPTION MODULE CONFIGURATION > menu key (note that if no VISION Option Module is installed, the <u>SET SYSTEM INFORMATION</u> screen does not display this menu key).

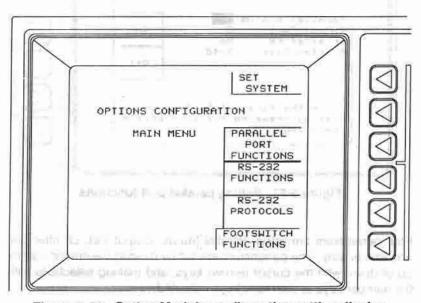


Figure 3-56. Option Module configuration setting display

This screen allows the setting of parameters so that accessories can work with EDM VISION. Parameters include settings that allow communication with external devices such as computers and printers, and the functions performed by the Foot Switch.

### Parallel port functions

configuration

Printers can be connected to the parallel port of the VISION Option Module. Parameters must be set to allow the parallel port to operate correctly. Press the < PARALLEL PORT FUNCTIONS > menu key.

programme trival by set for the weeter

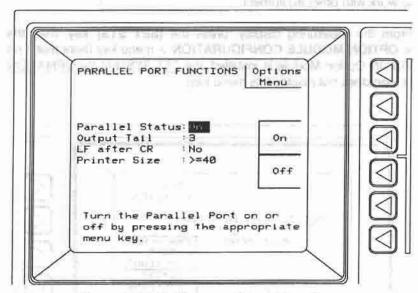


Figure 3-57. Setting parallel port functions

Four parameters are listed: Parallel Status, Output Tail, LF after CR, and Printer size. The parameters are set by moving the cursor-control up or down with the cursor (arrow) keys, and making selections with the number keys or the menu keys indicated.

The "Parallel Status" parameter turns the port on or off. Selecting "OFF" disables printing.

The "Output Tail" parameter allows setting the number of blank lines that will follow the printed information. The output tail can be zero to nine lines in length.

The "LF after CR" parameter can provide a line feed following the carriage return which normally ends each printing line. Selections are "Yes" or "No". Some printers require a line feed signal, others automatically feed a line each time a carriage return is sensed. Check the reference manual for the printer to determine the setting required for this parameter.

The "Printer Size" parameter determines the format of the printed data, either a "wide" or "narrow" format. The same information is printed with either setting. Settings are either less than 40 columns, or 40 or more columns. Most "letter-size" printers allow 40 columns of characters to be printed. Printers that use calculator-type rolls usually provide less than 40 columns of printing.

After setting the parameters, press the < Options Menu > menu key.

RS-232 functions

Two RS232-C serial ports are included with the VISION options module. Parameters must be set to allow external devices connected to the ports to communicate with the module. The external devices will have to be set in a similar manner; refer to the reference manual furnished with the external device for further information.

From the <u>OPTIONS CONFIGURATION MAIN MENU</u>, press the < RS-232 FUNCTIONS > menu key.

silvani, ECM-VERSIN no varial indomination and environmental and devices

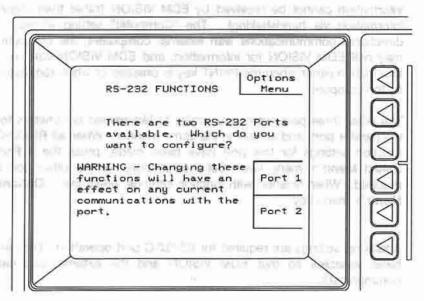


Figure 3-58. RS-232 FUNCTIONS screen

Press one of the "Port" menu keys to set parameters for the port.

Selecting the port

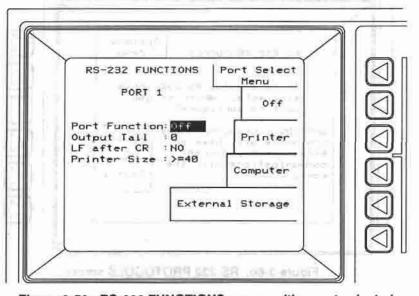


Figure 3-59. RS-232 FUNCTIONS screen with a port selected

### Setting characteristics

Four parameters must be set: Port Function, Output Tail, LF after CR, and Printer Size.

to the port to communicate with the readule. The

The Port Function parameter sets up communications relationships for the port. Choices are: Off, Printer, and Computer; and are set with menu keys. An additional menu key, External Storage, is shown, but is non-functional for EDM VISION. Choosing "Off" turns off the communications with the external equipment. The "Printer" setting allows EDM VISION to pass information to an external device only; information cannot be received by EDM VISION (other than status information via handshaking). The "Computer" setting allows bidirectional communications with external computers; the computer may poll EDM VISION for information, and EDM VISION can send information either when the PRINT key is pressed or when requested by the computer.

The other three parameters are similar to like-named parameters for the parallel port, and are set in the same manner. When all RS232-C function settings for this port have been made, press the < Port Select Menu > menu key. Set the functions for the other port if required. When finished with function settings, press the < Options Menu > menu key.

### RS232-C protocols

Additional settings are required for RS232-C port operation. They set basic variables so that EDM VISION and the external unit can communicate.

From the <u>OPTIONS CONFIGURATION MAIN MENU</u> screen, press the < RS-232 PROTOCOLS > menu key.

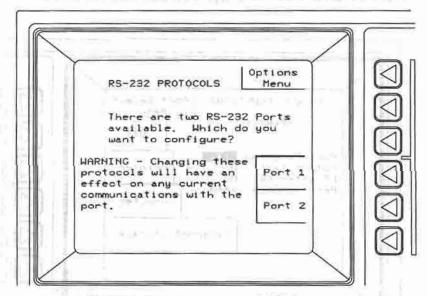
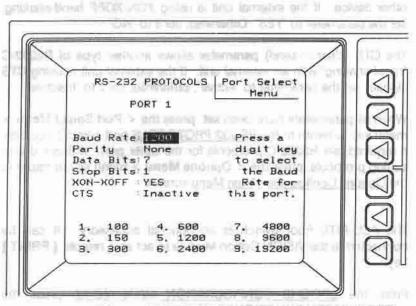


Figure 3-60. RS-232 PROTOCOLS screen

PROPERTY OF THE 20A PERMITTER A COMPANIES WITH A POST SCHOOL OF



The other to the policy of care device to redemine 5 without of the

Figure 3-61. RS-232 PROTOCOLS screen with a port selected

Six parameters must be set. They include: Baud Rate, Parity, Data Bits, Stop Bits, XON-XOFF, and CTS. They must be set as required by the external equipment connected to the port. Refer the external equipment's reference manual for information.

Move the highlight up and down with the cursor-control (arrow) keys. Follow the instructions that appear or use the menu keys that are presented for setting that parameter.

The Baud Rate sets the rate at which data is passed from EDM VISION to the external unit, or vice versa. The baud rate must be the same for both units.

Data communications across an RS232-C communications link consist of discrete blocks of a data "package". The data package contains data, parity bits, and stop bits. Both EDM VISION and the external unit must be set to the same values for these characteristics.

The Parity parameter allows use of parity checking for data errors, to help avoid mistakes in sending data across the RS232-C communications link. Some units require an even parity, some an odd, and some do not use parity checking.

The Data Bits parameter defines the length (in bits) of each data block sent across the RS232-C communications link. Some equipment requires 7-bit communication, and some requires 8-bit.

The Stop Bits parameter defines the number of bits in each data package sent that are reserved for Stop Bits. Settings are either 1- or 2-bits.

### Setting characteristics

Foot Syltch Kindbots

The XON-XOFF parameter allows use of software "hand-shaking". This refers to the ability of one device to recognize the status of the other device. If the external unit is using XON-XOFF hand-shaking, set the parameter to "YES" Otherwise, set it to "NO".

The CTS (clear-to-send) parameter allows another type of RS232-C "hand-shaking" with an external unit. If the external unit is using CTS signals, set the parameter to "Active"; otherwise, set it to "Inactive".

When all parameters have been set, press the < Port Select Menu > menu key to return to the RS-232 PROTOCOLS port selection screen. If required, set RS232-C protocols for the other port. If finished with setting protocols, press the < Options Menu > menu key to return to the Options Configuration Main Menu screen.

### Foot Switch functions

Lakerstay no probed

freq ant pathoried

The ACU-RITE Foot Switch is an optional accessory. It can be connected to the VISION Option Module to act as a remote [ PRINT ] key.

From the <u>OPTIONS CONFIGURATION MAIN MENU</u>, press the < FOOTSWITCH FUNCTIONS > menu key.

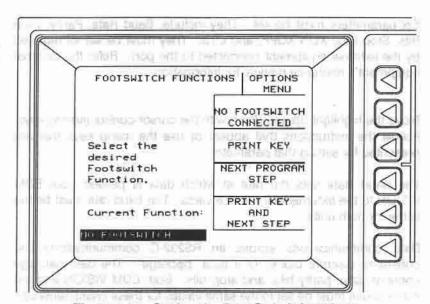


Figure 3-62. Setting the Foot Switch functions

Four settings for the Foot Switch action are shown: NO FOOTSWITCH CONNECTED, PRINT KEY, NEXT PROGRAM STEP, and PRINT KEY AND NEXT STEP. However, the NEXT PROGRAM STEP and PRINT KEY AND NEXT STEP functions are not available with EDM VISION.

Pressing the < NO FOOTSWITCH CONNECTED > menu key disables the Foot Switch. Pressing the < PRINT KEY > menu key enables the remote printing function. Whenever the Foot Switch is

pressed, printing information is sent from EDM VISION the same as if the front panel [ PRINT ] key were pressed.

EDM VISION provides a convenience feature for the SET SYSTEM parameter setting routine. When setting parameters, sometimes the operator will have to return to the DRO display (which ends the SET SYS session) to check a setting, then return to SET SYS to continue setting additional parameters. Or, one setting may have to be changed frequently during normal operations (such as with display resolutions; where a coarse resolution is commonly set for roughing operations, and a fine resolution is set for finishing operations).

When returning to the SET SYS function, press the < **Jump to where SET SYS was left** > menu key. The display returns to the same point in the system parameter setting routine where it was left.

### Jump to a prior point within the setup program

## Section 4. EDM operations

The following instructions are presented as a review of setup procedures. Follow along with the steps listed to assure that EDM VISION has been set up properly. If necessary, review the detailed parameter setting instructions given in <a href="Section 3.">SET SYS: EDM VISION setup operations</a>. If a VISION Option Module has been installed, parameters must also be set for the Option Module to work with other accessories.

### **Getting started**

Label the axes. Press [ SET SYS ], < SET AXES >, enter the password, and press < LABEL AXES >. Set a label for each axis to be displayed, for up to four axes. The CFI axis (used for the EDM ram) must be labeled as Z. Press < Finished > when done.

Label the axes

Set the encoder parameters. Press < SET PARAMETERS >. Note the axis for which information is shown. Set the encoder type, resolution, FTO availability, and counting direction. For the Z-axis, set pulsed or steady outputs.

Set axis parameters

Press another axis key and set the appropriate parameters for that axis. Repeat for additional axes. Press < AXIS INFORMATION > when done.

Set error compensation for each axis. Press < ERROR COMPENSATION >, then an axis key. Set up a measuring standard on that axis, and follow the screen instructions to perform either an automatic or manual single-interval compensation sequence.

Set error compensation

Set Eight diamays

Or, press < INTERVAL ERROR COMP >, set the Home Reference Point (FTO), and follow the screen instructions to perform an automatic or manual multiple-interval compensation. If necessary, edit the values by pressing < EDIT >.

Select the next axis by pressing the menu key and an axis key, then repeat the above steps. When finished with all axes, press < AXIS INFORMATION >.

Set the Home Reference Point for all axes equipped with FTOs. If already done in step 3, skip this step. Press < SET REF. POINT >, press an axis key, and follow the instructions to set the reference point. When done, press < FINISHED >.

Set Home Reference

Select the next axis by pressing an axis key, then repeat the above steps. When finished with all axes, press < SET SYSTEM >.

### Set DRO displays

Getting started

Label the axes

Sul likis parameters

- Set the DRO measuring display characteristics. Press < SET DRO AND EDM DISPLAYS > and < DRO DISPLAY FORMAT >.
- Select a display position by moving the cursor up or down with the arrow keys; the top-most position corresponds to the top-most DRO display position. Press [ CLEAR ], then an axis key to allow that axis to be displayed in that position.
- Set the display resolution for that axis. Move the cursor to the middle column with the arrow keys. For first-time operators, set the display resolution to the same as the resolution of the encoder.
- Set the "Approaching Zero Warning" point for that axis. Move the cursor to the last column, then enter a value with the number keys.
- Repeat the above sequence for up to four display positions on the DRO display. If more axes are available, they can only be viewed by assigning one of the current axis labels to the new axis (refer to "Assigning axis labels" in Section 3. SET SYS: EDM VISION setup operations).

## Set the EDM measuring display characteristics. Press < EDM DISPLAY FORMAT >.

- Move the cursor up or down and set display resolutions for the three Z-axis displays. For first-time operators, set the display resolution to be the same as the resolution of the encoder.
- Set the bar graph availability. Move the cursor down to this characteristic, and make the setting. For first-time operators, set the bar graph to "On".
- Set the type of measurement to be displayed. For firsttime operators, select both absolute and incremental displays.
- When finished, press < SET DISPLAYS > and < SET SYSTEM >.

## If no option module was installed, skip this step and press [DRO/EDM]. If an Option Module has been installed, press < OPTION-MODULE CONFIGURATION >.

If external equipment is to be attached to the parallel port, set the communications functions. Press < PARALLEL PORT FUNCTIONS >. Move the cursor up or down and make settings as required. Refer to the reference manual of the external equipment for settings required.

### Set EDM displays

### Set option features

Sat Home Reference

- If external equipment is to be installed on one or two of the RS232-C serial ports, set the communications functions. Press < RS-232 FUNCTIONS > and select a port. Move the cursor up or down to individual functions, and make settings for status, output tail, line feed, and printer size. Refer to the reference manual of the external equipment for settings required. When finished, press < PORT SELECT MENU >.
- If required, set functions for the other RS232-C port in the same manner. When finished with setting functions, press < Options Menu >.
- Set RS232-C protocols. If making settings for step 7b, also make settings here. Press < RS-232 PROTOCOLS > and select a port. Move the cursor up or down to individual characteristics, and make settings for baud rate, parity, data bits, stop bits, XON-XOFF, and CTS. Refer to the reference manual of the external equipment for settings required. When finished, press < PORT SELECT MENU >.
- If required, set protocols for the other RS232-C port in the same manner. When finished with setting protocols, press < Options Menu >.
- Set Foot Switch functions. If a Foot Switch accessory has been installed, press < FOOTSWITCH FUNCTIONS > to make settings for the action the Foot Switch will perform. Select either no operation or printing. When finished, press the [ DRO/EDM ] key.

All internal parameters for EDM VISION should now be set, and the EDM VISION measuring / control system is ready for work. The remainder of this section details how EDM VISION features work, and offers suggestions to assist the operator with common EDM machining operations.

were and MOI resign appears powers CHET proper a page of the course I

Access at an investment of their property of the company point of the property of the company of

made award along the not in CTTs) of the consected in contract and areas being

form in manner and office it may need early with any or one or a second second and any of the second second

tol qui antifea

EDIM operations

### DRO mode: setting up for EDM operations

The basic DRO and EDM displays were explained in "Section 2. Getting acquainted with EDM VISION features". This section will give further details about the DRO and EDM displays. It will explore ways to control the displayed information by setting parameters using the [SET SYS] key. Details about display modification functions that are activated with some of the keys will also be given. Finally, explanations of full-screen functions that temporarily replace the measuring displays will be given.

The DRO measuring mode is commonly used for setting up a workpiece prior to starting EDM operations. The workpiece is attached to the table, measurements are taken to establish the location of the electrode in relationship to the workpiece, and the DRO display is used to position the workpiece under the electrode as needed to produce the required feature.

### DRO mode display

Refer to Figure 4-1 to review the DRO display features.

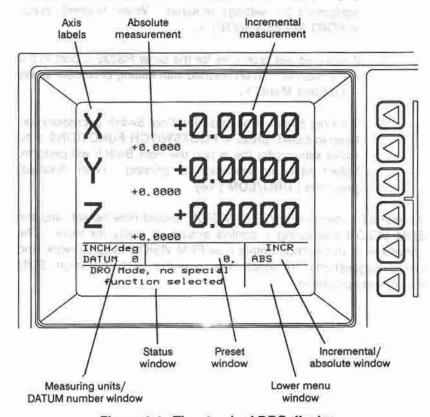


Figure 4-1. The standard DRO display

Figure 4-1 shows a typical DRO display screen, for an EDM machine with three axes: X, Y, and Z. Note the axis labels and axis display positions. The display resolution for each axis has been set to match the encoder resolutions, which are 10um on all axes. These settings can be made with [SET SYS] settings, and are the factory default values.

In addition, the Home Reference Points (FTOs) for all axes have been found, and error compensation has been set. Both incremental and

absolute measurements have been zeroed for all axes, and INCH and DEG settings have been made. No other functions have been activated.

of thickness new lesses works will the say increases also act.

This will be referred to as the "standard DRO display". Many of the following examples will start with this display. If trying out the features with the examples listed, and the state of current settings is unknown, the operator can reset EDM VISION to the standard DRO display by pressing the [SET SYS] key, then the < MISCELLANEOUS > and < RESET ALL MEMORY > menu keys and confirming the reset. Reference point locations must also be re-established, and the other settings noted in the previous paragraph.

#### CAUTION

Resetting all memory will reset all parameter settings to the factory default values. Current absolute and incremental measurements will be reset to zero. All settings (such as DATUM offsets, Spark Points, etc.) will be set to zero or reset.

Beginning with the standard DRO display, move each axis slightly so that just the least-significant-digit (the right-most digit) in each display changes. All axes should now read 0.0005, on both the absolute and incremental measurement displays. This confirms the settings for encoder and display resolution, and measuring units. The installer may have made other settings to match the resolution of the encoders installed. Each axis display must be the same as the resolution of the encoder installed on that axis (or its English measuring unit equivalent).

THE PROPERTY OF THE PROPERTY OF THE PORT OF SERVICE AND A SET OF SERVICE OF SERVICE AND ASSESSMENT OF SERVICE OF SERVICE AND ASSESSMENT OF SERVICE OF SERV

the takens will become man are awar or or region

arts creaves in any distribution in substitute the right-ring in survival about

sing at transportations talescentary and golden pelotypic throughly in

MANAGEMENTAL AND BEEN THE ANY BOOK IN THE THE THE MANAGEMENT OF THE PARTY OF THE PA

or help come to deep readerpart, the ORD dayley appropriately

**EDM VISION** 

visionly artifectively

salernitien rille

ED11 179-

Modifying the display with parameter settings The axis parameters set with the above steps were protected by a password, and are normally not changed after the initial setup on the machine. Several parameters, however, are operator-convenience settings, and can be changed several times on one job. These parameters do not require a password entry.

with will been bedrictable on an overtible and another must convey a

bits HOM bits amount in foll branes, send min anythmers

Press the [ SET SYS ] key.

No office fundame nave back

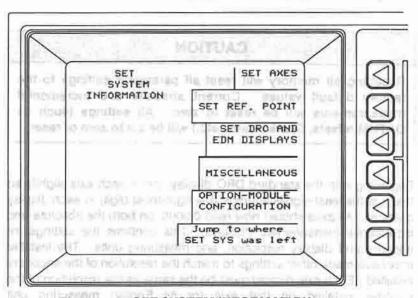


Figure 4-2. SET SYSTEM INFORMATION screen

The menu key selections entitled < SET REF. POINT > and < SET DRO AND EDM DISPLAYS > are features that the operator will use often to modify the display.

The < SET REF. POINT > menu key allows setting of Home Reference Points; these points must be set whenever EDM VISION is turned on or power has been interrupted. The absolute and incremental measurements are zeroed, and DATUM 0 is in effect when EDM VISION is turned on again; however the previous relationship to DATUM 0 and to the other DATUMs will not be reestablished until the Home Reference Points are found. Setting the Home Reference Points re-establishes the relationship between the machine tables and the electrode. Setting the reference points modifies the displays by setting the incremental measurement to zero at the reference point, and the absolute measurement to the point at which it was last zeroed. DATUM 0 is still shown, and all DATUMs will have the same relationship as before power was interrupted. Refer to "Setting the Home Reference Point" in Section 3. SET SYS: EDM VISION setup operations for information on how to set the Home Reference Points.

The < SET DRO AND EDM DISPLAYS > menu key allows setting of the DRO and EDM display resolution, the DRO display approaching

zero warning point, and other EDM display features. The display resolution setting determines the number of decimal places shown on the display, and can set a coarser resolution for display than the resolution of the encoders. The approaching zero warning point setting determines where the display will begin the flashing, close-to-zero warning display.

JUNEAU AND MORNING HIS TONORWINGSHOT BRAINED O

committee in a confidence of professional and professional

Changes to the EDM display screen are discussed in a later topic.

Two keys directly affect the DRO display. The [INCH/MM] key changes the linear measuring units whenever it is pressed. The measuring displays immediately change to display the measurement in the opposite units, and the units selection shown in the measuring units/DATUM number window changes to the new selection.

oral process of your ensurements and laterated bee visitable

Single-key DRO display modification features

Mild New DRO display

medification leabates

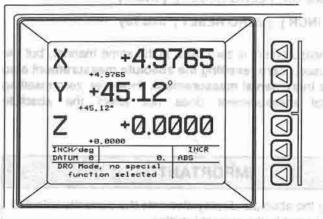


Figure 4-3. Typical DRO display (with the Yaxis as an angular axis) with inch, decimal degrees units settings

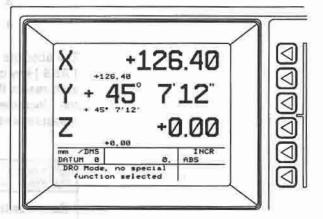


Figure 4-4. The same DRO display with mm, degrees-minutes-seconds units settings

The [ DEG/DMS ] key changes the angular measuring units display for axes that are defined as angular. For angular displays, notice the difference in notation: decimal degrees displays are shown as XX.XXXX°; degrees-minutes-seconds displays are shown as XX° XX' XX". Pressing the [ DEG/DMS ] key also changes the units selection shown in the measuring units/DATUM number window to the new selection.

ni menta is mritinot,... istriko sitsik tettaporta noktumbini... teritoresi.

geriefe waste in in Main-1916 and milit. Injurity ring in Advisualt in automo-

MWCphilips to Cortien homeone sales will pull-year two as its

training, that appoints a country training as she graph the

Basis like yalqada self paterida saland oon boo oo dha dab bati batika

profession with Window Middle Release nine and View state nine which species

craid lynd pair and paids and leads to be with a firm of the firm

Inemerosasim

### Multi-key DRO display modification features

Songle-lay DEO display

modification features

The same D 10 and for all the

Several multiple-keypress features are available with EDM VISION that modify the DRO display. They include zero resetting; absolute, incremental, and reference presetting; the DATUM setting routine; and the edge find routine.

reference gentlemb wit respect the pulsable and anyther market school reference

### Zero resetting

The current measurement can be reset to zero, or "zeroed", before beginning the next measurement sequence or before presetting. Both absolute and incremental measurements may be reset to zero. Zero resetting is a multiple-keypress sequence.

Any of the following sequences will zero reset the incremental measuring display:

1. [ ZERO RESET ], axis key, [ INCR ]

Source share one Dirth dealer. The ENCHARM Lines

- 2. [ ZERO RESET ], [ INCR ], axis key
- 3. Axis key, [ ZERO RESET ], [ INCR ]
- 4. [ INCR ], [ ZERO RESET ], axis key

The absolute measurement is zero reset in the same manner, but the [ABS] key is used. Zero resetting the absolute measurement also zero resets the incremental measurement. However, zero resetting the incremental measurement does not affect the absolute measurement.

#### IMPORTANT

Zero resetting the absolute display also sets the currently-selected DATUM's zero point to the current location.

More than one axis may be zero reset at the same time. Using sequence 1 or 3 from the above list: after pressing one axis key, press a second one; then continue the sequence. When finished with the sequence, both axes' measurements are reset to zero. This arrangement does not work with sequence 2 or 4; as soon as an axis key is pressed, the routine is completed and the display returns to normal operations.

Notice that the information window changes during the zero resetting operation. Information about the status of the operation is shown in the windows to help the operator keep track of which steps in the operation have been completed. Similar information is given during presetting operations.

### Presetting the incremental measurement

The incremental display is commonly preset to indicate the distance to the next position. The most common method of working with presets involves setting the incremental display to zero (zero resetting), then applying a preset. Starting at the preset, the incremental measurement decreases as the movement is made. When the axis has moved the preset distance, the display will read zero.

Using presets contrasts with moving without presetting, in which the operator must observe the present measurement; mentally or by using paper and pencil, calculate the desired measurement when the next feature is reached; then move the axis to match that measurement. This method is prone to error, and requires a much higher degree of operator concentration.

Incremental presetting is a multiple-keypress sequence. As noted, the incremental measurement is usually reset to zero before applying the preset. Any of the following sequences will preset the incremental measuring display:

Numeric entry, axis key, [ INCR ]

I've valued from the measurement bottle the charles will

- 2. Numeric entry, [ INCR ], axis key
- 3. Axis key, numeric entry, [ INCR ]
- 4. [ INCR ], numeric entry, axis key

"Numeric entry" means pressing any of the number keys, as well as the [.] and [+/-] keys as needed. To restart a numeric entry, press the [CLEAR] key.

THE X HOLD THE PROPERTY OF THE PARTY OF THE

More than one axis may be preset at the same time. Using sequence 1 or 3 from the above list: after pressing one axis key, press a second one; then continue the sequence. When finished with the sequence, both axes' measurements are preset. This arrangement does not work with sequence 2 or 4; as soon as an axis key is pressed, the routine is completed and the display returns to normal operations.

Note that when the axis key is the first key pressed, the upper menu key changes to < FREEZE >. This feature allows the operator to hold the current incremental and absolute measurements on the display, while moving the electrode or edge finding probe out of the way. The operator can then get at the workpiece to make a physical measurement to compare to the frozen measurement display. To use the feature:

Attenuation of calculationary and another of the calculation of the ca

- Press the < FREEZE > menu key. The incremental and absolute displays for that axis are frozen at their current measurements, and the message "FROZEN" appears underneath the primary measurement on that axis. Further movements on that axis will be recorded internally, but will not be shown. Other axes continue to operate in the normal manner. The upper menu key changes to < THAW >.
- Move the workpiece away from the electrode or edge finder probe. Use a micrometer or other measuring tool to measure the feature, and compare the physical measurement to the displayed measurement.

Using the "FREEZE" feature



- Any difference may be used to preset the absolute and/or incremental display, to correct for electrode wear, etc.

  Enter the preset number, and press the ABS or INCR keys to complete the operation.
- While the measurement is "frozen", it may be "thawed" (released from the measurement hold; the display will show the last position plus any movement since becoming "frozen") by pressing the < THAW > menu key.

To preset the display for a 2.25" movement in the positive direction:

- Zero reset the axis. [153H] yatru- inomust
- Press the [X], [2], [.], [2], [5], and [INCR] keys. The X-axis incremental display now reads -2.25".

[ BOM ] Andrew printers of a good of lock

Move the axis so that the incremental measurement reads zero. The axis has moved exactly 2.25" in the positive direction.

#### Presetting the absolute measurement

Named Village, entropy

The absolute measurement is usually preset only once for each part, to establish the relationship between the part edge and the main feature of the part from which all other features are dimensioned. This is often done by using the Edge Finder accessory and the [EDGE FIND] feature (which will be explained later in this section).

screenes pould. Items steek off in health duriett Ashard chart of the

Absolute presetting is a three-part sequence similar to incremental measurement presetting. Use the same methods as indicated above, but use the [ABS] key.

Yolf fire cather increasing and singular pressurements on the curture with recovery to a localistic environment on a localistic within the control of the co

emerge Transport and the property of the prope

digition or electrically with most game procuping you much the solidate sol

Like zero resetting the absolute measurements, presetting the absolute measurement will affect both the absolute and incremental measurements. For example, starting with the following display:

marry and the suddense deathers are designed been been been and

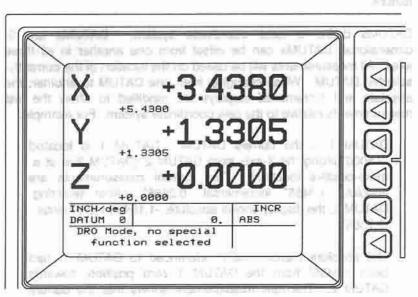


Figure 4-5. Typical DRO display

As an example of presetting the absolute measurement:

Preset the X-axis absolute measurement to 1.5". Press the [X], [1], [.], [5], and [ABS] keys. The X-axis absolute measuring display now reads +1.5 inches, and the incremental measurement is zero.

beautiful of the parties undergraph it betsupplies with a feel of the only included

Move the axis so that the absolute display is zero. The axis has moved exactly 1.5 inches in the negative direction. The incremental measurement reads -1.5.

A reference preset sets the incremental display to a measurement indicating the movement to be made to get to a specific point relative to the current DATUM point. DATUM 0 is commonly used as the workpiece zero point; reference presets for DATUM 0 would indicate movement to be made relative to workpiece zero. For example:

archit and world becomes to Prof. 55 S. Illians, Respect that world the

The workpiece must have a 0.5000" thickness at this position. The absolute display shows the current position above the table, as the absolute display was zeroed on the table surface (which corresponds to the bottom of the workpiece).

Press the [Z], [.], [5], and [REF] keys. The incremental measurement is now referenced to the absolute measurement, but offset by 0.5000". Move the axis so that the incremental measurement is zero. The absolute measurement shows 0.5000", as required.

Using reference presetting

#### Using the DATUM setting routine

DATUMs are reference points that can be defined on the workpiece. They are most useful when a part has minor features that are related to a main feature (such as a group of holes around a central hole). This method of locating features is commonly found on engineering blueprints, where the main feature is dimensioned from workpiece zero and the additional features are dimensioned from the main feature.

DATUMs define a local coordinate system. DATUMs are 3-dimensional; DATUMs can be offset from one another in all three axes. All measurements will be based on the location of the currently-selected DATUM. When changing from one DATUM to another, the absolute and incremental displays are modified to show the last measurements relative to the new coordinate system. For example:

DATUM 1 is the current DATUM. DATUM 1 is located -2.5000" along the X-axis from DATUM 2 (DATUM 2 is at a more-positive location). The current measurements are absolute: 1.3455", incremental: -0.2565". After selecting DATUM 2, the display shows absolute: -1.1545", incremental: -2.7565".

The absolute measurement, referenced to DATUM 1, had been 1.3455" from the DATUM 1 zero position, towards DATUM 2. The new measurement shows that the current position is -1.1545" (+1.3455" + (-2.5000")) from the DATUM 2 zero position.

Similarly, the incremental position had been -0.2565" from the DATUM 1 zero position, away from the DATUM 2 position. The new measurement shows that the current position is -2.7565" (-0.2565" + (-2.5000")) from the DATUM 2 zero position.

Up to ten DATUM points, designated 0 through 9, can be defined. An additional special DATUM, "Machine 0", is available; it is discussed later as a part of the SET POINT routine.

Datum 0 is used as the workpiece zero point. It is referenced from the Machine Zero position, which is in turn referenced from the Home Reference Point. DATUMS 1-9 are referenced from Datum 0. All DATUMs are thus referenced from the Home Reference Point. If power is lost and then restored (or EDM VISION turned OFF and then ON), the EDM machine setup can be restored by finding the Home Reference Point.

Using DATUMs is a two-step operation. The DATUM must be located or set, and it must be selected.

Selecting DATUM points

The Home Reference Point is normally found and a Machine Zero established prior to setting DATUM points. To select DATUMs, at the standard DRO display press the [ DATUM ] key.

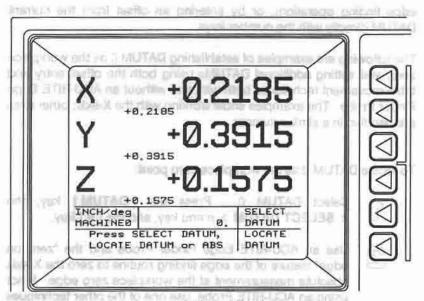
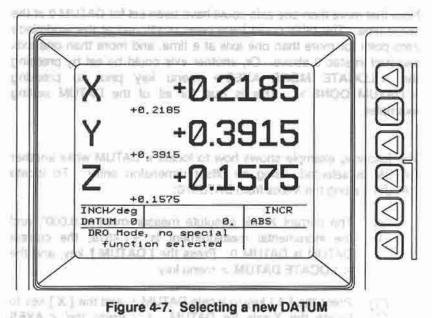


Figure 4-6. Select DATUM screen

The currently-selected DATUM is shown in the measuring units/DATUM number window of the display. To select another DATUM, press the < SELECT DATUM > menu key, then press a number key for the new DATUM.



The display reverts to the normal DRO mode display, with the new DATUM selected. aug medi , peoprine (accoup adfore promoco)

There are two ways to establish DATUM positions: by moving the axis tables to the position for the DATUM (usually in combination with an

Setting DATUM points

P MUTAU snesou

edge finding operation), or by entering an offset from the current DATUM directly with the number keys.

The following are examples of establishing DATUM 0 as the workpiece zero, and setting additional DATUMs using both the offset entry and table movement techniques both with and without an ACU-RITE Edge Finder Probe. The examples show working with the X-axis; other axes are handled in a similar manner.

#### Locate DATUM 0

To locate DATUM 0 as the workpiece zero point:

Select DATUM 0. Press the [DATUM] key, the < SELECT DATUM > menu key, and the [0] key.

Use an ACU-RITE Edge Finder Probe and the "zero on edge" feature of the edge finding routine to zero the X-axis absolute measurement at the workplece zero edge. If not using an ACU-RITE Probe, use one of the other techniques suggested in the topic "Edge finding".

The display will show that DATUM 0 is selected, and the absolute display will be set to one-half of the edge finder's ball diameter (or the edge finder offset dimension, if using a non-spherical probe). Move the table so that the X-axis absolute display is zero. The electrode holder is now positioned directly over the workpiece zero edge; this is the DATUM 0 zero position.

Note that more than one axis could have been set for DATUM 0 at the same time. The table could have been positioned at the workpiece zero point for more than one axis at a time, and more than one axis selected in step 3 above. Or, another axis could be set by pressing the < LOCATE MORE AXES > menu key prior to pressing < DATUM DONE >. This is true for all of the DATUM setting examples.

#### Setting DATUMs with an offset entry

The following example shows how to locate a DATUM while another DATUM is selected, using an offset dimension entry. To locate DATUM 1 along the X-axis from DATUM 0:

- The current X-axis absolute measurement is 0.000", and the incremental measurement is +1.4515; the current DATUM is DATUM 0. Press the [DATUM] key, and the < LOCATE DATUM > menu key.
- Press the [1] key to locate DATUM 1, and the [X] key to locate the X-axis for DATUM 1. Press the < AXES SELECTED > menu key.
- Enter 2.500" with the number and [.] keys (the number appears in the preset window), then press the < DATUM DONE > menu key.

The display reverts to the DRO mode display, with DATUM 0 selected. The absolute and incremental displays have not changed. Select

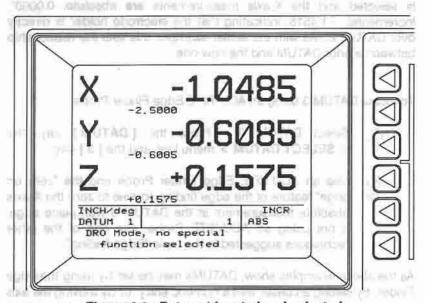
EDM VISION

Selling UATUM points

DATUM 1 by pressing the [DATUM] key, then the < SELECT DATUM > menu key and [1] key. The absolute measurement is -2.5000", and the incremental measurement is -1.0485; both have been offset by -2.5000". These measurements indicate that the DATUM 1 zero position is 2.5000" more-positive than the DATUM 0 zero location.

Note that this method sets up a hierarchy of DATUM points, in that the just-set DATUM is referenced to the previous-selected DATUM. If the first DATUM is set to a new zero point, the second DATUM will maintain the offset relationship that has been established.

S MUTAC half anogar wedney nathon MUTAR safeu enhusion as?



of regulard 1 Figure 4-8. Datum 1 located and selected most and a

Figure 4-8 shows the effects of the above changes. DATUM 1 is selected, and includes the offsets established from DATUM 0.

The following example shows how to locate a DATUM by moving the axis to the desired position:

- DATUM 2 will be established at +4.0000" from DATUM 0 along the X-axis. Select DATUM 0 so that DATUM 2 can be referenced from it: press [DATUM], < SELECT DATUM >, and [0]. The measuring unit/DATUM number window shows that DATUM 0 is selected. The X-axis measurements revert to the previous measurements shown with DATUM 0; absolute: 0.000", incremental: +1.4515".
- Select the DATUM and axes to be established: press [DATUM], < LOCATE DATUM >, [2], [X], < AXES SELECTED >.

the least exploit the categorith and notice to the Physics will be with the will be

Setting DATUMs with a movement

Desired DAT ustrawith the Edge

- Establish the X-axis offset between DATUM 0 and DATUM 2: move the X-axis to the point where DATUM 2 is to be established. The absolute measurement will read 4.0000" (since the absolute measurement reflects the distance from DATUM 0). Press the < DATUM DONE > menu key. At this position, the DATUM 0 X-axis measurements are absolute: +4.0000, incremental: +5.4515, which reflects the movement just made.
  - Press the [ DATUM ] key, then the < SELECT DATUM > menu key and [ 2 ] key.

The measuring units/DATUM number window reports that DATUM 2 is selected and the X-axis measurements are absolute: 0.0000", incremental: +1.4515, indicating that the electrode holder is directly over DATUM 2. As with the earlier example, this sets the relationship between a prior DATUM and the new one.

#### Setting DATUMs with the Edge Finder

To locate DATUM 3 using an ACU-RITE Edge Finder Probe:

- Select DATUM 3. Press the [DATUM] key, the < SELECT DATUM > menu key, and the [3] key.
- Use an ACU-RITE Edge Finder Probe and the "zero on edge" feature of the edge finding routine to zero the X-axis absolute measurement at the DATUM 3 workpiece edge. If not using an ACU-RITE Probe, use one of the other techniques suggested in the topic "Edge finding".

As the above examples show, DATUMs may be set by using the Edge Finder, by setting an offset with a numeric entry, or by moving the axis to the location for the new DATUMs zero point. DATUMs 1 through 9 are referenced to DATUM 0 or to one another, depending on the current DATUM selection while setting the location for their zero points.

WILLIAG most compliance at a fin attractor bas included

### Edge finding

The edge finding routine can be used from either the DRO or EDM display modes to zero the current measurement, locate workpiece features and edges, and to perform measurements directly on the workpiece without removing it from the setup. In the DRO display mode, the edge finding routine can be used with the ACU-RITE Edge Finder Probe accessory, another manufacturer's probe, or an electrode. The following instructions give details about setting up EDM VISION to work with the probe or electrode, and examples of how to use the edge finding routine.

In the EDM display mode, the edge finding routine works with the special First-Spark Detector accessory; this use is detailed later in this section.

The edge finding routine works most efficiently when the cable supplied with the Edge Finder Probe is connected to EDM VISION to automatically sense contact with the workpiece. The Probe may also be used without the cable; an indicator on the Probe will light when

contact with the workpiece is made, and the operator must manually indicate to EDM VISION that contact has been made.

#### CAUTION

one VICHTOF MCB negwird by spring his year

If an Option Module has been installed, the Edge Finder Probe connector must be plugged into the receptacle on the Option Module rather than the receptacle on the CPU Module. In addition, a jumper on the CPU Module must be moved.

If the jumper is not set properly, the CPU or Option Module may be damaged. Refer to Section 1. Installation for instructions.

#### CAUTION

Never turn the EDM machine's power on during edge finding operations, except when using the First-Spark Detector.

When using the ACU-RITE Edge Finder Probe, another probe with a cable attached, or an external contact indicator, make sure that the cable or indictor is disconnected from the electrode holder and workpiece before beginning EDM operations.

The operator may be injured. The Probe, cable, electrode, EDM VISION, the EDM machine, or other equipment may also be damaged.

Other manufacturer's edge finding probes may be used, with or without a connecting cable between the probe and EDM VISION. If other probes do not provide the same type of workpiece-contact signals provided by the ACU-RITE Edge Finder Probe, a cable cannot be used and EDM VISION's automatic sensing feature will not work. Refer to "Appendix E. VISION Option Module connectors" in <a href="Section-6.">Section 6.</a> Appendices for information about the connector that must be used and wiring instructions.

If the probe provides an external indication of contact sensing (such as a built-in lamp), it may be used with EDM VISION's manual methods.

Probes without external indicators and EDM electrodes may also be used for edge finding operations by providing an external contact indicator (such as a battery-operated lamp or buzzer) connected between the electrode and the workpiece. The electrode must not be under power. Contact between the probe or electrode and the workpiece will complete the circuit and activate the indicator. The operator would use manual procedures to indicate to EDM VISION that the workpiece edge has been found.

#### IMPORTANT

A cable may be connected between EDM VISION and other manufacturer's probes or an EDM electrode to provide automatic contact sensing. To allow this use, the probe or electrode must be electrically isolated from the remainder of the machine. This is normally the case with EDM machines.

To check for isolation, use a continuity tester between the probe or electrode and the workpiece; there must not be continuity.

more the street and the modeleds on the Option

#### IMPORTANT

Electrodes are slightly smaller than the feature that they will create. Remember that when using an electrode to zero current measurements, measure features, locate features, etc. this size variation must be accounted for.

The edge finding routine offers several options that modify both incremental and absolute DRO measurements. The Probe and routine can be used on any axis, but only one axis at a time. The examples given below illustrate both automatic and manual sensing operations, and using both symmetrical and non-symmetrical probes or electrodes.

of and hand-one of the married to a contract

Getting started

Install the Edge Finder Probe in the EDM machine electrode holder. The most common arrangement is for the Probe to be installed in a quick-change holder, so that the relationship between the sensing ball and EDM machine electrode holder remains constant with each setup; this will be assumed for all edge finding examples. Install the Edge Finder Probe and holder into the electrode post on the EDM machine; install the cable between EDM VISION and the Probe.

If using another probe or an electrode, install it in the holder. If using automatic sensing, connect the cable to EDM VISION. If using an external contact indicator, connect the indicator between the workpiece and the probe or electrode.

An offset dimension must be established to work with the probe or electrode. This sets the dimension from the outer surface of the probe that will contact the workpiece, to the center of the electrode holder. An offset must be set for each axis. For probes, which are usually spherical or round, this will be a single dimension for the X-and Y-axes. For EDM electrodes or other irregular probe shapes, a specific offset must be established for the sensing surface selected for the X- and Y-axes. The Z-axis (and W-axis, if provided) must be set with a specific offset; this axis uses the tip of the probe or electrode to sense the workpiece.

The offset dimension works in combination with settings for Machine Zero and DATUM positions, which are based on the location of Home Reference Points (encoder FTOs). Measurements obtained with the edge finding routine are referenced to the current DATUM.

#### IMPORTANT

The Home Reference Points should be found before working with the edge finding routine, so that DATUMs are referenced to the intended points on the workpiece.

EDM VISION defaults to DATUM 0 at power-up, with both absolute and incremental measurements reset to zero at the **current location**. Unless the Home Reference Points are found, edge finder measurements will be referenced to this starting point.

Two methods of setting edge finder offsets are provided. Either a ball diameter may be set (for symmetrical probes or electrodes), or a specific offset may be established (for non-symmetrical probes or electrodes). Using a spherical ball probe such as the ACU-RITE Edge Finder Probe allows setting a single offset (for the X- and Y-axes) that is valid for contacting any orthogonal (parallel to the three axes) surface of a workpiece from any direction in the X/Y plane.

Specific offsets must be used with irregular probe or electrode shapes, or with probes or electrodes that are not centered on the electrode holder. These devices can only be used in one direction, using the same sensing surface for each edge contact.

Some probes or electrodes will be symmetrical in one or more axes, such as a cylindrical probe or electrode. Offsets for cylindrical sensing devices are set in the same manner as spherical devices. For sensing devices that are symmetrical in one axis, the width of the symmetrical feature can be set for the symmetrical axis and specific offsets set for the non-symmetrical axes. This allows the symmetrical axis of the feature to sense edges from either direction. The non-symmetrical axes can still only be used in one direction.

If not using the ACU-RITE Edge Finder Probe or other type of probe or electrode with at least one symmetrical feature, skip ahead to the next topic, "Setting the offset for non-symmetrical probes or electrodes".

cardiford to overdow or ode, centrally the 2 arts, when

The width of the sensing device (or ball diameter) and the location of the center of the probe or electrode with respect to the touching edge must be established. This will allow EDM VISION to offset measurements for the effect of the symmetrical sensing device. Before starting this procedure, note the counting direction for the table; moving to the right (or down) produces either more-positive or more-negative DRO counting.

intest deed and unitable and half MiGHIV will about

Setting the offset for a symmetrical Probe or electrode

From the standard DRO display, press the [SET POINT] key, and the < Edge Finder Offsets > menu key.

Setting the "Ball Diameter"

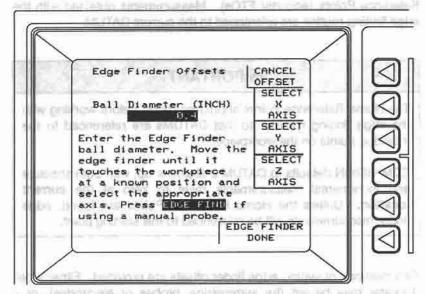


Figure 4-9. Entering the Edge Finder Probe ball diameter

Title of A cell to door Allow lind borration monthly

Enter the diameter of the Edge Finder Probe ball. For ACU-RITE Probes, the ball diameter is 0.400" for the English model, or 10 mm for the metric model. If necessary, press the [INCH/MM] key to set the correct units.

For other spherical probes, or probes or electrodes that are symmetrical in this axis, enter the edge-to-edge width across the probe or electrode in the X-axis.

Move the table so that the Edge Finder Probe touches a surface perpendicular to the X-axis travel (parallel to the Y-and Z-axes). For probes or electrodes that use automatic sensing via the interconnected cable, a highlighted message, "Edge Finder TOUCHING" appears on the display; with the ACU-RITE Probe, the lamp inside the Edge Finder Probe also lights.

#### CAUTION

anasa Milinaya katiba na katawa katiba ini wakili 2004 ilin Alekin peliku tifin 1

Be careful not to over-drive an axis, especially the Z-axis, when using the ACU-RITE Edge Finder Probe or an electrode. The Probe, electrode, workpiece, or EDM machine may be damaged.

If using another type of probe that provides an external contact indicator or with an external contact sensing circuit that is not connected to EDM VISION, monitor the external indicator for the "just-touching" point. Press the [EDGE FIND] key when the correct position is found; this signals EDM VISION that the position has been found.

is suit lead? to estimption of

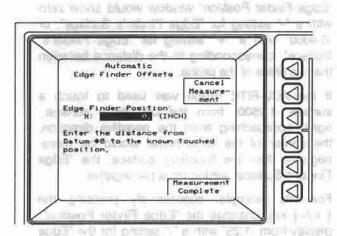
syrothedrick? Peoble or elections

to tome to their one groups

The "Edge Finder TOUCHING" message appears after pressing the key. arit to automic independent rittle field atold

[=\c+1

Press the < SELECT X AXIS > menu key. One of two second "Edge Finder Offsets" screens appear.



value and back. Was tru ACO-RITE Proposition

Figure 4-10. Establishing the Edge Finder offset to the current DATUM, with automatic of a balacol sensing the move of the serble

regist out to street behind several to the waterbooks middle to partition produced to continue unit include

spring DA LAST also point to the workplace edge than

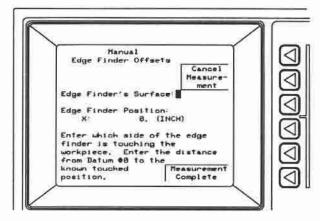


Figure 4-11. Establishing the Edge Finder offset to the current DATUM, with manual sensing

Figure 4-10 shows the screen that is displayed when using automatic sensing. Figure 4-11 illustrates the screen that is displayed when using manual sensing. Note that an extra entry is required for manual sensing. window. The measurement uncomposeds to the distance

printed and the second

For manual sensing with a symmetrical probe or electrode only, the "Edge Finder's Surface" indicator shown in Figure 4-11 must be set. This indicator does not appear when using automatic sensing.

The "Edge Finder's Surface" setting indicates which side of the symmetrical probe or electrode touched the workpiece. If the center of the symmetrical probe or electrode is more-negative than the edge used for touching the workpiece surface, the setting must be negative. If the center of the symmetrical probe or electrode is more-positive than the edge used for touching the workpiece surface, the setting must be but no positive.

but I'de I d. I welcom and print mornisation Use the cursor-control keys to move the highlight to the setting, and use the [+/-] key to make the setting. The following is an example of setting the "Edge Finder's 

> the center of the probe or electrode is morenegative than the surface of the edge finding device that touched the workpiece; use the [+/-] key to set a "-".

Setting the "Edge Finder's Surface"



Chine of two

Setting the "Edge Finder Position"

Setting the Edge Finder's

'Boetsoll'

If the DATUM 0 surface was touched, the lower "Edge Finder Position" measurement should be 0. Note that with successive presses of the [+/-] key, the measurement shown for the "Edge Finder Position" changes from zero to the ball diameter value and back. With the ACU-RITE Probe, the "Edge Finder Position" window would show zero with a "-" setting for "Edge Finder's Surface", or -0.4000" with a "+" setting for "Edge Finder's Surface", corresponding to the distance between the two sides of the probe.

> If the ACU-RITE Probe was used to touch a surface -1.2500" from the DATUM 0 surface, again approaching from the negative direction, the center of the edge finder would be morenegative than the touching surface; the "Edge Finder's Surface" setting must be negative.

For this example, successively pressing the [+/-] key changes the "Edge Finder Position" display from -1.25" with a "-" setting for the "Edge Finder's Surface", to -1.65" with a "+" setting. These displays represent the locations of the two sides of the symmetrical Probe, located to the right or to the left of the center of the electrode holder; they represent touching features at either side of the Edge Finder, but where the electrode holder was at the same position. with high manual funding lygin legs a

A measurement is shown in the "Edge Finder Position" window. The measurement corresponds to the distance from the current DATUM's zero point to the center of the electrode holder, modified by the "Ball Diameter" setting. The indicator does not appear when

This measurement should match the dimension from the current DATUM's zero point to the workpiece edge that was touched; in most cases the measurement will match. If the symmetrical probe is slightly off-centered, a small difference in dimension will be observed.

stratedes in trains-harming the the odge used for

Measure the actual distance from the current DATUM surface to the surface touched and compare it to the "Edge Finder Position" window measurement. necessary, move the highlight to the "Edge Finder Position" with the cursor-control keys and enter the actual measurement using the number, [.], [+/-], and [CLEAR] keys. The entry must represent the position of the surface that the Probe's ball or electrode's edge has touched, relative to the current DATUM's zero point. Direction is important! If the touched surface is beyond the current DATUM surface in the positive measuring direction for this axis, the entry must be positive.

#### **IMPORTANT**

If the wrong setting was made for the "Edge Finder's Surface" setting, the position shown will be incorrect by the "Ball Diameter" setting. Verify that the correct surface has been touched, that the "Edge Finder's Surface" setting is correct, and that the "just-touching" point has been accurately located before manually entering an "Edge Finder Position". If necessary, press the [+/-] to change the "Edge Finder's Surface" setting.

add not beetle for pointing milit 20036 Mild interprets

EDM VISION uses the difference between the measurement shown in the "Edge Finder Position" window and the numeric entry to determine the offset, if any, to apply during edge finding operations.

The following are examples of setting the "Edge Finder Position" for a symmetrical probe or electrode:

the most common method of setting the "Edge Finder Position" is to touch the DATUM 0 surface of the workpiece; there should be no offset. The measurement shown in the "Edge Finder Position" window should be zero. If necessary, enter 0".

If the ACU-RITE Probe was used to touch a surface -1.2500" from the DATUM 0 surface, the "Edge Finder Position" window should also display -1.2500". If the "Edge Finder Position" measurement does not match the actual measurement, enter the actual measurement with the numeric entry keys.

When finished, press the < Measurement Complete > menu key. The display reverts to the first Automatic Edge Finder Offsets screen, to allow setting of Edge Finder offsets on other axes.

If the probe or electrode is symmetrical in the Y-axis, set the offset for the Y-axis in a similar manner by repeating steps 1 to 6. If non-symmetric probe offsets or the Z-axis offset must be set, continue with step 2 in the next topic, "Setting the offset for a non-symmetrical probe or electrode". If finished with offsets, press the < EDGE FINDER DONE > menu key to retain these offsets and return to the SET POINT Main Menu. From this screen, press the [ DRO/EDM ] key to return to the measuring display.

#### IMPORTANT

If the < EDGE FINDER DONE > menu key is not pressed at the end of the Edge Finder offset routine, the new offsets will be lost. The previous offsets will remain in place.

#### Setting the offset for a nonsymmetrical probe or electrode

The location of the workpiece-touching surface from the center of the electrode holder must be established for non-symmetrical probes or electrodes. This location must also be established for the Z-axis (and W-axis, if provided). EDM VISION then creates an offset for the sensing device which will be applied to non-symmetrical edge finding operations.

Establishing the location of the workpiece-touching surface of the non-symmetrical sensing device is similar to setting offsets for symmetrical sensing devices, except that no setting is required for the "Edge Finder's Surface" indicator; these devices can only be used in one direction.

Before starting this procedure, note the counting direction for the table; moving to the right (or down) produces either more-positive or more-negative DRO counting.

- From the standard DRO display, press the [SET POINT] key, and the < Edge Finder Offsets > menu key. The display will be the same as the Edge Finder Offsets screen shown in Figure 4-9.
- Clear the ball diameter, if a previous entry has been made.

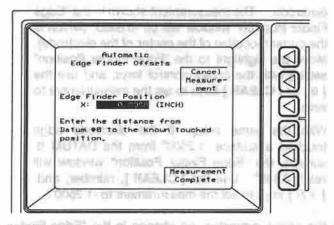
  Press the [0] or [CLEAR] key.

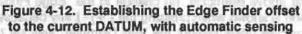
#### Set the "Ball Diameter" to zero

#### IMPORTANT

If a ball diameter had previously been set to allow using the Probe, it must be set to zero for proper offsetting based on a non-symmetric probe or electrode and for the Z- or W-axis.

Move the X-axis table so that the probe or electrode touches the workpiece. If automatic sensing is used, a highlighted message, "Edge Finder TOUCHING", is displayed. If not connected to EDM VISION, use the external indicator to find the "just-touching" point, then press the [EDGE FIND] key. Press the < SELECT X AXIS > menu key.





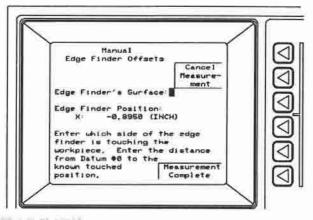


Figure 4-13. Establishing the Edge Finder offset to the current DATUM, with manual sensing

Figure 4-12 shows the screen that is displayed when using automatic sensing. Figure 4-13 illustrates the screen that is displayed when using manual sensing. There is an extra entry, for "Edge Finder's Surface", shown with the manual-sensing screen. For non-symmetric probes or electrodes, an "Edge Finder's Surface" entry is not required; any entry made has no effect.

4

edutare

adora Itic

A measurement is shown in the "Edge Finder Position" window. This value corresponds to the absolute measurement (the location of the electrode holder) from the current DATUM. An offset value must be established to correct the reading for the edge finding object; this offset is calculated by EDM VISION based on the operator's entry of an "Edge Finder Position".

Since the object being used for edge finding is nonsymmetrical, an offset can be set for only one side of the object; the defined edge must be used for all subsequent edge finding operations.

Measure the actual distance from the current DATUM surface to the surface touched, and enter that dimension using the number, [.], [+/-], and [CLEAR] keys. The entry must represent the position of the surface that the probe or electrode's surface has touched, relative to the current DATUM. Direction is important! The entry must be positive if the touched workpiece surface is further along the positive measuring direction for this axis, relative to the DATUM surface. As an example of setting the "Edge Finder Position" for a non-symmetrical probe or electrode:

an electrode has a sensing edge located 0.8950" to the positive side of the electrode center, for use with movements in the positive direction. Touch the DATUM 0 surface with the sensing edge of the electrode. The measurement shown in the "Edge

Set the offset

electrode. The measurement shown in the "Edge Finder Position" window will be -0.8950" (which is the current location of the center of the electrode). Move the highlight to the "Edge Finder Position" setting with the cursor-control keys, and use the [0] or [CLEAR] keys to set the measurement to zero.

With the same setup, if the electrode edge touched a surface -1.2500" from the DATUM 0 surface, the "Edge Finder Position" window will read -2.145". Use the [CLEAR], number, and [+/-] keys to set the measurement to -1.2500".

Note that with the above examples, no change in the "Edge Finder Position" dimension is shown when pressing the [ +/-] key because there is no symmetrical offset setting; the "Ball Diameter" was set to zero.

- When finished, press the < Measurement Complete > menu key. The display reverts to the first Automatic Edge Finder Offsets screen, to allow setting of Edge Finder offsets on other axes.
- Set offsets for other axes using a non-symmetrical probe or electrode, and for the Z-axis (and W-axis, if provided), by repeating steps 1 through 5. When finished, press the < EDGE FINDER DONE > menu key to retain the offsets and return to the SET POINT Main Menu. From this screen, press the [DRO/EDM] key to return to the measuring display.

#### IMPORTANT

If the < EDGE FINDER DONE > menu key is not pressed at the end of the Edge Finder offset routine, the new offsets will be lost. The previous offsets will remain in place.

Whenever the Edge Finder Probe is used to locate edges, it will report the distance from the current DATUM's zero position to the edge touched. Refer to "Using the edge find routine" later in this section for instructions on working with the Edge Finder.

Using the edge find routine

are plant gha etc garteros es

Edge finder offsets have now been established for each axis using one of the above two methods. The offsets will be employed each time the edge finding routine is used.

Offsets for both symmetrical and non-symmetrical probes or electrodes are used in a similar manner. The device touches a surface, and the absolute measurement reports the location of the touched surface from the current DATUM's zero surface.

For symmetrical probes or electrodes, the device may be used bidirectionally on that axis (edges on the workpiece may be approached and touched from a positive or a negative direction). The offset dimension is the same to either side of the electrode holder.

With non-symmetrical electrodes or probes, only one edge of the device can be used for edge finding operations on that axis: the edge of the edge-finding object that was used to establish the offset. For example:

if the device was moved from left-to-right to touch a left-side surface of the workpiece (with a right-side edge of the edge-finding object) in establishing an axis offset, only left-side surfaces of the workpiece may be probed. No relationship has been established for the device edge to the left of the electrode holder.

If a right-side surface of the workpiece must be probed, the offset must be reset to reflect the left-hand side of the device. Or, an extension bar may be held against the right-hand surface, and the left surface of the extension probed.

To begin an edge-finding operation on the X-axis, start with the standard DRO display and press the [EDGE FIND] key, then the X-axis key.

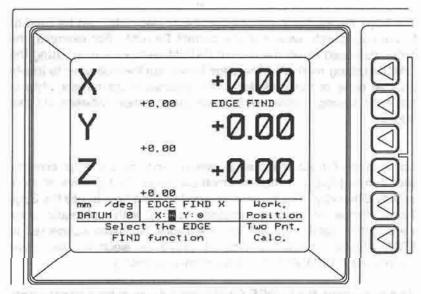


Figure 4-14. DRO display with edge finding routine activated

An "EDGE FIND" message appears under the X-axis primary measurement display. The probing operation setting and axis selection is repeated in the preset window, and a highlight appears over the "center" Edge Finder's Surface indicator. Two menu keys appear: < Work. Position > and < Two Pnt. Calc. >.

If an edge finder offset has been set using a symmetrical probe (the ACU-RITE Edge Finder Probe or other symmetrical probe or electrode), the incremental and absolute displays do not change. If an edge finder offset has been set using a non-symmetrical probe or electrode, the incremental and absolute measurements are preset by the offset value.

Figure 4-14 reflects offset settings for a symmetrical probe or electrode.

Press the [+/-] key; the "Edge Finder's Surface" indicator in the preset window changes from "center" to "-" to "+" with successive key This feature is provided for manual edge-finding operations with symmetrical probes or electrodes, to inform EDM VISION which edge of the probe or electrode is to be used so that the edge finder offset can be applied in the correct direction. The probing operation indicator is not required when using automatic sensing (provided by connecting a cable from EDM VISION to the probe or electrode). With automatic sensing, EDM VISION automatically senses the direction of movement during edge finding operations and offsets measurements in the correct direction. It is not required for non-symmetrical probes or electrodes; these devices are only used with one direction of approach, and an Edge Finder's Surface setting was made within the edge finder offset routine in the previous topic, "Setting the offset for a non-symmetrical probe or electrode".

#### Locating edges with the edge finder

The Edge Finder Probe (or other probe or electrode) can be used to locate edges with respect to the current DATUM. For example, the probe can used to set the current DATUM zero point (see "Using the DATUM setting routine"). The edge finder can then be used to locate another edge of the workpiece; the absolute measurement while in the edge finding routine will indicate the distance between the two edges.

#### Edge finding with a symmetrical probe, using automatic sensing

The routines for automatic edge sensing and manual edge sensing, with symmetrical and non-symmetrical edge finding devices work slightly differently. The following example shows how to use the Edge Finder Probe or other symmetrical device with automatic edge sensing (the cable supplied with the Probe has been connected to EDM VISION, or another type of probe or electrode has been connected to EDM VISION using a fabricated cable).

As noted earlier, the [EDGE FIND] and [X] keys have already been pressed. Move the X-axis until the probe touches.

The Edge Finder Probe (or other probe or electrode) can be used to locate edges with respect to the current DATUM's zero point. For example, the probe can used to set the current DATUM zero point (see "Using the DATUM setting routine"). The edge finder can then be used to locate another edge of the workpiece; the absolute measurement while in the edge finding routine will indicate the distance between the two edges.

e WART > of preprint promited and

Locating edges with the edge finder

The routines for automatic edge sensing and manual edge sensing, with symmetrical and non-symmetrical edge finding devices work slightly differently. The following example shows how to use the Edge Finder Probe or other symmetrical device with automatic edge sensing (the cable supplied with the Probe has been connected to EDM VISION, or another type of probe or electrode has been connected to EDM VISION using a fabricated cable).

Edge finding with a symmetrical probe, using automatic sensing

SCHOOL BUILDING WELFARD TO SEE

As noted earlier, the [ EDGE FIND ] and [ X ] keys have already been pressed. Move the X-axis until the probe touches.

#### CAUTION

Be careful not to over-drive an axis, especially the Z-axis, when using the ACU-RITE Edge Finder Probe or an electrode. The Probe, electrode, workpiece, or EDM machine may be damaged.

When the edge is sensed:

- the X-axis measurement changes to a reverse-video display while the probe is touching.
- an "EF FROZEN" message appears under the primary measuring display for that axis.
- the incremental measurement is zeroed at the time of contact; further X-axis movements will be reported.
- the absolute measurement is "frozen", and shows the distance from the current DATUM zero point to the touched surface. This measurement is the location of the center of the electrode holder from the current DATUM zero point at the time of contact (as would be shown on the DRO display for that axis), plus or minus one-half of the "Ball Diameter" setting. The addition or subtraction of half of the Ball Diameter is determined automatically by the direction of movement at the time of contact. For example:

automatic sensing is being used with the ACU-RITE Edge Finder Probe. The absolute measurement represents the distance from the current DATUM to the center of the electrode holder. If the absolute measurement was increasing, and was 1.0000" just at the point of contact, the measurement will be "frozen" at 1.2000"; the "Edge Finder's Surface" indicator would be set to "-" (the center

of the electrode holder is determined to be in the negative direction from the touching edge of the edge finder).

If the absolute measurement was decreasing, and was 1.0000" just at the point of contact, the measurement will be "frozen" at 0.8000". Here, the "Edge Finder's Surface" indicator would be "+".

- the upper menu changes to < THAW >.
- the Edge Finder's Surface indicator changes to show the direction assigned at the contact. Note the above examples.

The frozen absolute measurement indicates the distance from the current DATUM zero point to the touched edge. Press the < THAW > menu key to cancel the frozen display and return to the DRO measuring mode. The absolute measurement reverts to the old measurement (plus any movement that has occurred while finding the edge), indicating the distance from the current DATUM zero point to the center of the electrode holder. The incremental measurement has been zeroed at the point where the edge was detected.

Note that the same actions would be provided by selecting the < Work. Position >, then the < LOCATE EDGE > menu keys, except that the menu keys displayed after touching the edge would be different.

will about the sales are the sales and the sales are

### Edge finding with a symmetrical probe, using manual sensing

Localding (depote which tax) will be

Tanakaharantera ara disebiganta di ngbis

Manual edge sensing is similar, but involves four additional steps, as shown in the following example. As before, the [EDGE FIND] key and [X] key have been pressed. Next:

The "Edge Finder's Surface" indicator shows "center" as the currently-active function. The absolute measurement shows the location of the center of the electrode holder from the current DATUM zero point.

Press the [+/-] key to set the indicator for the surface of the probe or electrode that will touch the work piece. If the center of the symmetrical edge finder probe or electrode is more-negative than the touching surface of the edge finder, select "-". If the center of the symmetrical edge finder probe or electrode is more-positive than the touching surface of the edge finder, select "+".

When selecting either "-" or "+", the absolute and incremental displays change to show the symmetrical offset effects: they are offset from the previous measurement by one-half the Ball Diameter setting. For example:

in the DRO mode, the absolute measurement shows the location of the center of the electrode holder from the current DATUM zero point. The incremental measurement is at a random point following a previous operation. After pressing the [EDGE FIND] and [X] keys, the "center" Edge

Finder's Surface indicator is active and both measurements remain the same.

Pressing the [+/-] key changes the Edge
Finder's Surface indicator to "-"; both absolute
and incremental measurements are increased
by one-half of the Ball Diameter setting. The
absolute measurement now indicates the location
of the active edge of the edge finder with
respect to the current DATUM zero point; the
active edge is the more-positive edge.

Pressthe [+/-] key again. The "Edge Finder's Surface" indicator changes to "+"; both absolute and incremental measurements are decreased by the "Ball Diameter" setting. The absolute measurement now indicates the location of the selected "+" surface of the edge finder with respect to the current DATUM zero point; the selected surface is the more-negative edge. This has the opposite effect of the "-" setting: the position of the center of the electrode holder had been increased by one-half the "Ball Diameter" setting with a "-" setting; here, the position of the center of the electrode holder is decreased by one-half the "Ball Diameter" setting.

- Press the < Work. Position >, then the < LOCATE EDGE > menu keys.
- Move the axis until the edge is sensed (as indicated by the external lamp or buzzer circuit). Press the < MANUAL TOUCH > menu key.

Several display items change, as noted in the automatic edge finding example above, except:

- the axis measurement does not flash a reverse video display
- the menu keys change to < VERIFY POINT > and < TRY AGAIN >

To assist with overcoming the uncertainty with manual edge finding operations, the operator can try locating the edge several times by using the < TRY AGAIN > menu key. This returns the routine to the same point as before the < MANUAL TOUCH > key was pressed.

When the operator is confident that the edge location is correct, the operation is completed by pressing the < VERIFY POINT > menu key.

Normal DRO operation is restored. The absolute measurement shows the location of the center of the electrode holder from the current DATUM zero point; the incremental display is zeroed at the verified edge find point.

# EDM VISION

non exiling pulpoil spoil

symmetrical scotta, using

Edge finding with a nonsymmetrical probe, using automatic sensing Edge finding with a non-symmetrical probe or electrode and automatic sensing is similar to using a symmetrical device with automatic sensing. However, since the device can only be used in one direction, the displays and features are slightly different.

Note the DRO mode absolute and incremental measurements; the DRO mode absolute measurement represents the distance from the current DATUM to the center of the electrode holder. With the non-symmetrical offset already established and starting from the DRO mode, press the [EDGE FIND] key, then the [X] key. The absolute and incremental measurements have been offset by the edge finder offset dimension (established with the "Edge Finder Position" setting while setting up the edge finder characteristics); the absolute measurement represents the distance from the current DATUM's zero point to the defined edge of the electrode.

The "Edge Finder's Surface" indicator shows "center" as the currently-active function. Pressing the [+/-] key changes the function to "-", then "+", then repeats, but has no effect on the measurements; edge sensing can only be accomplished in one direction, as set by the non-symmetric active edge, and the corresponding offset has already been applied.

- Press the < Work. Position >, then the < LOCATE EDGE > menu keys.
- Move the axis until the edge is sensed.

#### When the edge is sensed:

- the X-axis measurement changes to a reverse-video display while the probe is touching.
- an "EF FROZEN" message appears under the primary measuring display for that axis.
- the incremental measurement is zeroed at the time of contact; further X-axis movements will be reported.
- the absolute measurement is "frozen", and shows the distance from the current DATUM's zero point to the touched surface. This measurement represents the location of the center of the electrode holder from the current DATUM zero point at the time of contact (as would be shown on the DRO display for that axis), plus the non-symmetrical offset value. For example:

automatic sensing is being used with an offset electrode. When the offset dimension was set, the electrode had moved in the positive direction to touch the edge, and the non-symmetrical offset was found to be -0.645" (the offset value is calculated by EDM VISION, based on the operator's entry for "Edge Finder Position").

The edge finding device can only approach the workpiece edge from one direction (in the positive direction, so that measurements are becoming more

positive), and can only use the defined edge finding surface to touch the workpiece.

If the absolute measurement was increasing prior to touching an edge, and the DRO mode measurement would have been 1.0000" just at the point of contact, the measurement will be "frozen" at 0.3550" (1.0000" + (-0.6450")).

- the upper menu changes to < THAW >.
- the Edge Finder's Surface indicator changes to show the direction assigned at the contact, but has no effect since no symmetrical offset (the Ball Diameter setting) has been established. Note the above example.

The frozen absolute measurement indicates the distance from the current DATUM zero point to the touched edge. Press the < THAW > menu key to cancel the frozen display and return to the DRO measuring mode. The absolute measurement reverts to the old measurement (plus any movement that has occurred while finding the edge), indicating the distance from the current DATUM zero point to the center of the electrode holder. The incremental measurement has been zeroed at the point where the edge was detected.

durintens in 1994 polarita Intimpro Medi

The edge finding routine for a non-symmetrical probe or electrode with manual sensing is similar to the routines for edge finding with a non-symmetrical probe or electrode with automatic sensing, and for edge finding with a symmetrical probe using manual sensing. The actions provided (such as changes to the absolute and incremental measurements) follow the routine for automatic sensing with a non-symmetrical probe or electrode. Display changes (other than the measurements) follow the routine for manual sensing with symmetrical probes. Refer to both of the above descriptions.

Edge finding with a nonsymmetrical probe or electrode, using manual sensing

est-kinded et live to the t

It is possible to have both types of edge finder offsets defined. This combination might be used where an electrode has a symmetrical feature that will be used for edge finding, but the center of the feature is not located at the center of the electrode holder. With this arrangement, both types of offsets would be activated after pressing the [EDGE FIND] key and an axis key; the Edge Finder's Surface indicator (set by pressing the [+/-] key) would preset the measurements beyond the preset that was activated because of the Edge Finder Position setting (within the "Edge Finder Offsets" routine).

The number of variations with this type of operation are too large to detail here. The operator should experiment with different settings to become familiar with this type of offsetting before attempting to use it for actual operations.

Edge finding with both symmetrical and nonsymmetrical offsets

#### Zero on edge detection

a produced produce or advertisery to

con been lacknessed one.

areaster femiliarity in

The zero-on-edge-detection routine accomplishes that action: when an edge is detected by the edge finding device, both absolute and incremental measurements for the DRO mode display are re-zeroed (so that the display will be zero when the center of the electrode holder is aligned with the detected edge). Although the exact actions are different with symmetrical and non-symmetrical edge finders, the results are the same.

Starting with the standard DRO display, press the [EDGE FIND] key, then the X-axis key. Press the < Work. Position > menu key. Two additional menus are displayed, < LOCATE EDGE > and < ZERO EDGE >. Press the < ZERO EDGE > menu key. If using a non-symmetrical probe or electrode with either automatic or manual sensing, the incremental and absolute displays are offset to accommodate the edge finder offset as soon as the axis key is pressed.

Note that for this setup, the absolute measurement would read zero if the table were moved so that the sensing edge of the probe or electrode were aligned with the current DATUM zero point.

For manual sensing with a symmetrical probe, set the Edge Finder's Surface indicator with the [+/-] key. The incremental and absolute displays are offset by one-half of the "Ball Diameter" setting to correspond to the appropriate indicator selection.

Note that for this setup, the absolute measurement would read zero if the table were moved so that the sensing edge of the probe were aligned with the current DATUM zero point.

With automatic sensing using a symmetrical probe, offsets are not shown. Offsets are applied only after the edge finder senses the edge; the direction of movement when the edge is detected sets the offset direction.

Move the X-axis table until the Probe touches an edge of the workpiece. For manual setups, press the < MANUAL TOUCH > menu key after locating the edge.

When the probe first touches the workpiece (or the < MANUAL TOUCH > menu key is pressed):

- the X-axis measurement changes to a reverse-video display while the probe is touching (only with automatic sensing).
  - an "EF FROZEN" message appears under the primary measurement.
  - the incremental measurement is zeroed. Further X-axis movements will be reported.

## **EDM VISION**

ord Inces

- the absolute measurement is "frozen" at zero at the time of contact, regardless of the previous measurement shown in the DRO display mode.
- the menus change to < VERIFY POINT > and < TRY AGAIN >.

Further movement of the X-axis is reported by the incremental measurement, but will not change the absolute measurement; the absolute measurement is "frozen" at 0 when the Probe touches.

- 4
- Press the < TRY AGAIN > menu key to release the freeze on the absolute measurement, allowing a second try. This feature allows the edge to be sensed several times to verify the actual "just-touching" point.
- Press the < VERIFY POINT > menu key to accept the sensed edge and complete the sequence. The display reverts to normal DRO operations.

After completing the zero-on-edge-detection routine, the display reverts to normal DRO operation. Both absolute and incremental measurements show the current location of the center of the electrode holder from the edge just sensed; they were offset to one-half of the ball diameter or to the axis offset value at the time of edge contact, and have recorded any further movement from that point. If the table is moved so that the sensed edge is directly under the center of the electrode holder, both measurements will be zero.

a does Printer's Tructure" ingredies a set for "1" for both south

The two-point calculation feature uses the Edge Finder Probe or another probe or electrode to touch parallel edges on the workpiece (that are aligned with that axis). EDM VISION then calculates the distance between the two workpiece features and locates the center of the two features. The results can be used to automatically move the location of the current DATUM to the center of the two features, or to preset the axis measurements so that the center of the two features can be positioned directly under the electrode holder.

Two-point calculations

perfection of the grifting of

Four types of two-point measurements can be made with EDM VISION's edge finding routine. These include leading-step, lagging-step, inside-to-inside (hole), and outside-to-outside (web) measurements. Symmetrical probes or electrodes can be used for all four types of measurements; non-symmetrical probes can only be used for leading- and lagging-step measurements.

For symmetrical probes, the type of measurement is determined by the "Edge Finder's Surface" indicator setting for the first point, the direction of movement between the two touch points, and the indicator setting for the second point. For manual sensing, the indicators are manually set for both touch points. For automatic sensing, the indicator settings are automatically sensed.

Non-symmetrical probes or electrodes are more restricted in their use than symmetrical probes. They can only be used to touch left- or Types of measurements

right-hand edges, not both. This precludes their use for outside-tooutside and hole measurements. No "Edge Finder's Surface" indicator settings are required.

Figures 4-15 through 4-18 illustrate the four types of measurements. An encoder counting direction has been arbitrarily assigned for these illustrations, with measurements increasing to the left.

#### Leading-step measuring

- with automatic sensing using symmetrical probes or electrodes: if both workpiece edges are approached in a positive manner (the incremental measurement is increasing), with either a positive or negative displacement between them, a "leading-step" or same-side-surfaces measurement is reported, with the center of the Probe on the negative side of the surfaces. Both "Edge Finder's Surface" indicator settings are automatically set to "-". In Figure 4-15 edge 2 may be first, and edge 1 second.
- with manual edge sensing using a symmetrical probe: if the "Edge Finder's Surface" indicator is set to "-" for both touch points, both workpiece edges are approached in a positive manner (the incremental measurement is increasing), and with either a positive or negative displacement between them, a "leading-step" or same-side-surfaces measurement is reported. The center of the Probe is on the negative side of both surfaces. In Figure 4-15 edge 2 may be first, and edge 1 second.
- with either automatic or manual sensing using a non-symmetrical probe or electrode: if the edge finder offset was established by touching a surface while moving in the positive direction, and with either a positive or negative displacement between the two touch points, all measurements will be "leading-step" or same-side-surfaces measurements. In Figure 4-15 edge 2 may be first, and edge 1 second.
- non-symmetrical probes or electrodes for which the edge finder offset was established by moving in the negative direction cannot be used for "leading-step" measuring.

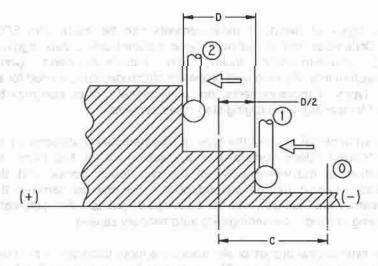


Figure 4-15. "Leading-step" measuring

Web measuring

provencin MoH

with automatic sensing using a symmetrical probe or electrode: if the first workpiece edge is approached in a positive manner, the second edge is approached in a negative manner, and there is a positive displacement between the two points, a "web" or outside-to-outside measurement is reported. The Probe center is on the outside of each surface. The "Edge Finder's Surface" indicator is automatically set to "-" for the first point, and "+" for the second.

Conversely, if the first workpiece edge is approached in a negative manner, the second approached in a positive manner, and there is a negative displacement between the two points, a "web" or outside-to-outside measurement is also reported. The "Edge Finder's Surface" indicator is automatically set to "+" for the first point, and "-" for the second.

with manual edge sensing using a symmetrical probe: if the "Edge Finder's Surface" indicator is manually set to "-" for the first touch point and the point approached in a positive manner; and set to "+" for the second touch point and the point approached in a negative manner; and there is a positive displacement between the two points, a "web" or outside-tooutside measurement is reported.

Conversely, if the "Edge Finder's Surface" indicator is manually set to "+" for the first touch point and the point approached in a negative manner; and set to "-" for the second touch point and the point approached in a positive manner; and there is a negative displacement between the two points, a "web" or outside-to-outside measurement is also reported.

 non-symmetrical probes or electrodes cannot be used for outside-to-outside measurements.

of local art famous reheateds on record famous manage as

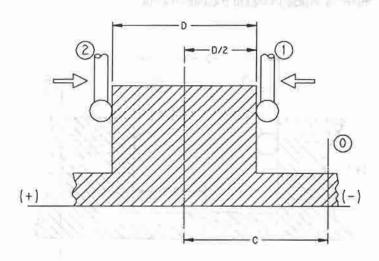


Figure 4-16. Outside-to-outside measuring

a ligare de 17. Misio assangaring

#### Hole measuring

githwaaaem tto W

with automatic sensing using a symmetrical probe or electrode: if the first touch point is approached in a negative manner, the second edge is approached in a positive manner, and a there is a positive displacement between the two points, a "hole" or inside-to-inside measurement is reported. The Probe center is on the inside of each surface. The "Edge Finder's Surface" indicator is automatically set to "+" for the first point, and "-" for the second.

Conversely, if the first workpiece edge is approached in a positive manner, the second edge is approached in a negative manner, and a there is a negative displacement between the two points, a "hole" or inside-to-inside measurement is also reported. The "Edge Finder's Surface" indicator is automatically set to "-" for the first point, and "+" for the second.

with manual edge sensing using a symmetrical probe: if the "Edge Finder's Surface" indicator is manually set to "+" for the first point and the first point is approached in a negative manner; and the indicator is manually set to "-" for the second point and the second point approached in a positive manner; and there is a positive displacement between the two points, a "hole" or inside-to-inside measurement is reported. The Probe center is on the inside of each surface.

Conversely, if the "Edge Finder's Surface" indicator is manually set to "-" for the first point and the first point is approached in a positive manner; and the indicator is manually set to "+" for the second point and the second point approached in a negative manner; and there is a negative displacement between the two points, a "hole" or inside-to-inside measurement is also reported.

 non-symmetrical probes or electrodes cannot be used for "hole" or inside-to-inside measurements.

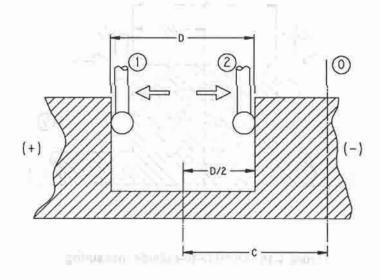


Figure 4-17. Hole measuring

Lagging-step measuring

- with automatic sensing using symmetrical probes or electrodes: if both workpiece edges are approached in a negative manner (the incremental measurement is decreasing), with either a positive or negative displacement between them, a "lagging-step" or same-side-surfaces measurement is reported, with the center of the Probe on the positive side of the surfaces. Both "Edge Finder's Surface" indicator settings are automatically set to "+". In Figure 4-18 edge 2 may be first, and edge 1 second.
- with manual edge sensing using a symmetrical probe: if the "Edge Finder's Surface" indicator is set to "+" for both touch points, both workpiece edges are approached in a negative manner (the incremental measurement is decreasing), with either a positive or negative displacement between them, a "lagging-step" or same-side-surfaces measurement is reported, with the center of the Probe on the positive side of the both surfaces. In Figure 4-18 edge 2 may be first, and edge 1 second.

as edge of the workplace. For manual sensing, price the

- with either automatic or manual sensing using a non-symmetrical probe or electrode: if the edge finder offset was established by touching a surface while moving in the negative direction, and with either a positive or negative displacement between the two touch points, all measurements will be "leading-step" or same-side-surfaces measurements. In Figure 4-18 edge 2 may be first, and edge 1 second.
- non-symmetrical probes or electrodes for which the edge finder offset was established by moving in the positive direction cannot be used for "leading-step" measuring.

I genu maran barrat en at aque vert racea, matiri

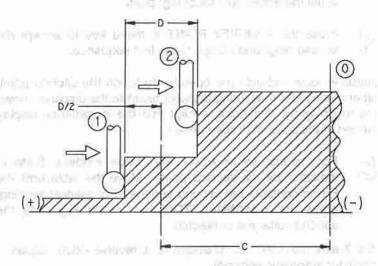


Figure 4-18. Lagging step measuring

Use the following procedure to measure two-point features:

From the DRO display mode, press the [EDGE FIND] and [X] keys and the < Two Pnt. Calc. > menu key. For manual sensing with symmetrical probes or electrodes, set the "Edge Finder's Surface" indicator as required.

electrodemi il trott vontpiace dalgas um approximitat in a

- Move the X-axis table until the probe or electrode touches an edge of the workpiece. For manual sensing, press the < MANUAL TOUCH > menu key. When the probe first touches the workpiece:
- the X-axis measurement changes to a reverse-video display (only for automatic sensing).
- an "EF FROZEN" message appears under the main display for that axis.
- the incremental measurement is zeroed at the time of contact; further X-axis movements will be reported.
- the absolute measurement is "frozen" at the time of contact, and displays the distance from the current DATUM zero point to the touched edge.
- the menus change to < VERIFY POINT > and < TRY AGAIN >.
- the status window reports that the first point was found, and requests verification.
  - Press the < TRY AGAIN > menu key to release the freeze on the absolute measurement, allowing a second try. This feature allows the edge to be sensed several times to verify the actual "just-touching" point.

mater set between in paters is management a

Press the < VERIFY POINT > menu key to accept the sensed edge and complete the first sequence.

The status window instructs the operator to touch the second point. The other menus and measuring displays revert to the displays shown prior to touching the first point, except that the incremental display was zeroed at the point of Probe contact.

- For manual sensing, set the "Edge Finder's Surface" indicator for the second point. Move the table until the Probe contacts the second surface. For manual sensing, press the < MANUAL TOUCH > menu key. As the second surface is contacted:
- the X-axis measurement changes to a reverse-video display (only for automatic sensing).
- an "EF FROZEN" message appears under the main display.
- the incremental measurement is zeroed at the time of contact; further X-axis movements will be reported.

- the absolute measurement is "frozen" at the current measurement at the time of contact, plus or minus one-half the ball diameter (depending on direction of movement).
- the menus change to < VERIFY POINT > and < TRY AGAIN >.
- the status window reports that the second point was found, and requests verification.
  - Press the < TRY AGAIN > menu key to release the freeze on the absolute measurement, allowing a second try.
  - Press the < VERIFY POINT > menu key to accept the sensed edge and complete the second sequence. After verifying the point:
- the status window reports "D: (distance)" and "C: (center)".
  The D dimension is the distance between the two edges; the C dimension is the distance from the current position to the location of the center of the two points.
- the absolute measurement reverts to the location of the center of the electrode holder from the current DATUM.
- the incremental measurement is zeroed at the last touch point.
- the menu keys change to < LOCATE CENTER > and < ZERO CENTER > (unless the current DATUM is Machine 0; there is no "zero center" feature for the Machine 0 DATUM).

The reports of length for dimension D and location of center C are depend on the type of measurement.

One of three actions can be taken:

- After noting the dimensions, revert to normal DRO operations by pressing the [EDGE FIND] key.
- Press the < LOCATE CENTER > menu key. Pressing the < LOCATE CENTER > menu key presets the incremental display, based on the "C" (distance to the center) dimension. Move the table to zero this display; the electrode holder will be located at the center of the two edges detected. The absolute measurement continues to show the location of the current DATUM zero point. Normal DRO operations continue from this point.
- Press the < ZERO CENTER > menu key. Pressing the < ZERO CENTER > menu key will change the location of the current DATUM zero point to the center of the feature, based on the "C" (distance to the center) dimension. The incremental and absolute displays will be preset to reflect the present location from the center of the feature (and the new current DATUM). Normal DRO operations continue from this point.

EDM VISION

19/01:ISTS A THIW

EDM mode: ger-

discharge

EDM mode display

forming electrical

macrifolog oper-

## EDM mode: performing electrical discharge machining operations

The EDM display mode is used while performing electrical discharge machining to monitor the progress of the "burning" operation. It presents information about the Z-axis only, and the status of the relay outputs commonly used to control the EDM operation and the machine's ram (Z-axis) automatic feed mechanism.

## **EDM** mode display

From the standard DRO display, press the [ DRO/EDM ] key. Refer to Figure 4-19 to review the EDM display features.

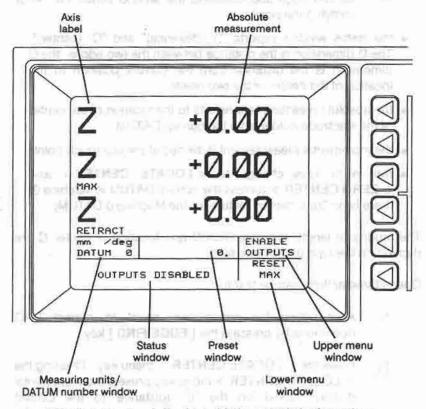


Figure 4-19. EDM display with factory default settings

The illustration represents a typical EDM display screen, where all settings are at the factory default values.

## Modifying the display with parameter settings

Many parameter settings will affect the EDM display. Two important settings are for the axis label and encoder type. Using an axis label other than Z for the CFI Module axis will eliminate the special EDM functions available with EDM VISION, and prevent the use of the control signals. One CFI Module axis must be labeled as Z for use of the special EDM control signals, and to allow use of the control signals from other CFI axes.

Setting the Z-axis for use as an angular axis will also eliminate the special EDM functions available with EDM VISION. With either of these settings, all measurement information can only be shown on DRO displays; no measuring information is shown when selecting the EDM display mode.

As with the DRO mode, most of the initial setup parameters are seldom changed from their original settings. Two parameters that are used often are the setting of Home Reference Points (although common practice is to set these reference points while in the DRO display mode, before starting EDM operations) and the EDM display format settings. Setting these parameters does not require entry of the password.

Setting of the Home Reference Points was explained for the DRO display mode. To set the EDM display format, press the [ SET SYS ] key, then the < SET DRO AND EDM DISPLAYS > and < EDM DISPLAY FORMAT > menu keys.

the Could Allen and Security of the Could add the Could be a second to

AT THE REPORT OF THE PARTY OF T

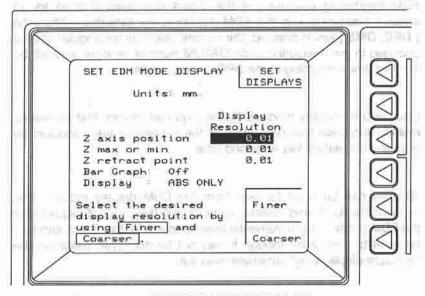


Figure 4-20. SET EDM MODE DISPLAY screen

Settings that can be made include: display resolution for the Z, Z<sub>MAX</sub>, and Z<sub>RETRACT</sub> measurements; availability of the bar graph display; and availability of the Z incremental measurement. The three display resolution settings are commonly changed during the course of producing a finished part. The operator typically will set a coarser resolution for positioning during the "roughing" EDM operations (which remove the majority of the material but do not require a high degree of precision). Then, for finishing operations, the operator typically will set the display resolution to the full resolution of the encoder, to control movements with a high degree of precision. Note, however, that the Retract Point is not affected by a coarser Z-axis display resolution setting; the retract circuits will use the full encoder resolution to compare to the Retract Point setting to determine when the retract signal occurs.

**EDM VISION** 

Single-low- EpiM display

modification features.

Widdle Fey ET M display

F. 191

Use of the bar graph display and the **Z** incremental measurement display tends to follow personal preference; some operators prefer using the features, and others do not. Typically, an operator will not change these settings after settling on the display that he is comfortable with.

Move the highlight over the current setting with the cursor-control keys, and use the menu keys to make the settings. Refer to <u>Section 3. SET SYS: EDM VISION setup operations</u> for additional information about setting these parameters.

## Single-key EDM display modification features

With EDM displays, only one key directly affects the EDM display. The [INCH/MM] key changes the measuring units whenever it is pressed. The measuring displays immediately change to display the measurement in the opposite units, and the units selection shown in the measuring units/DATUM number window changes to the new selection.

to valve exapple for even are watering to it? parties, any other necessi-

Unlike the DRO display mode, the [ DEG/DMS ] key does not affect EDM measuring displays. If the Z-axis has been defined as an angular measuring axis, the EDM display is not available. When the [ DEG/DMS ] key is pressed, the current selection for angular units is changed in the measuring units/DATUM number window, and will be in effect when returning to the DRO display mode.

## Multi-key EDM display modification features

Like the DRO display mode, EDM displays can be modified by several multiple-keypress features. Most of these features are cancelled by pressing the feature key a second time.

## Zero resetting

All axes can be reset to zero from the EDM display mode. This includes the X-, Y- and W-axes, even though they are not displayed in the EDM mode. The incremental measurement for the Z-axis can also be reset to zero, even though it may not be displayed (because the "absolute display only" parameter was set).

## Presetting

Presetting includes incremental, absolute, and reference presets. Presets for the Z-axis follow the same procedures as those for the DRO displays. Refer to that section for details. As noted above, the operation is performed on the selected axis even though that axis' measurements are not displayed.

## The first-spark detection (edge find) routine

The first-spark detection feature is provided to work in conjunction with the ACU-RITE First-Spark Detector accessory and an EDM electrode. The feature is activated with the [EDGE FIND] key while in the EDM display mode. When the First-Spark Detector is properly connected to the EDM machine and to EDM VISION, EDM VISION uses that signal to establish the relationship between the EDM electrode and the workpiece. In this way, it operates like the Edge Finder Probe for edge detection. However, since this routine uses the actual electrode and spark settings to determine locations, it is a

much more accurate method; the small amount of electrode undersizing to provide a spark gap is accommodated. The feature cannot be used while the EDM outputs are enabled. Power must be applied to the electrode while using the first-spark feature.

#### CAUTION

The electrode will be under power while using the first-spark feature. Do not touch the electrode, workpiece, or other components. The operator may be injured.

Do not use an edge-finder probe with this feature. The probe or EDM VISION may be damaged.

While in the EDM display mode, press the [ EDGE FIND ] key.

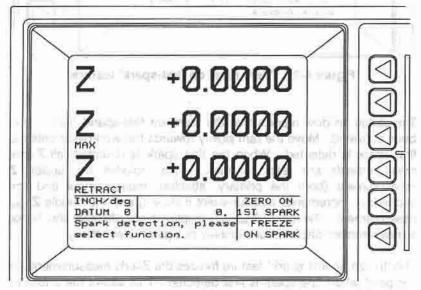


Figure 4-21. First-spark detection feature

Two options are available, and can be selected by pressing the appropriate menu keys: < ZERO ON 1ST SPARK >, or < FREEZE ON SPARK >.

The "zero reset on first-spark" feature resets the Z-axis Incremental and absolute measurements to zero when the first-spark condition is detected. Press the < ZERO ON 1ST SPARK > menu key.

us the electrode while using the Redugate Resident

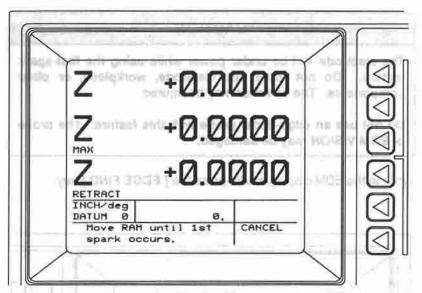


Figure 4-22. "Zero reset on first-spark" feature

The status window reports that the "zero on first-spark" feature has been activated. Move the ram slowly towards the workpiece until the first spark is detected. When the first spark is detected, all Z-axis measurements are reset to zero. This includes the upper, Z measurement (both the primary, absolute measurement and the secondary, incremental measurement if shown) and the middle Z max measurement. The lower, Z RETRACT display is not affected; this is not a measurement display, but a display of a parameter setting.

The "freeze on first-spark" feature freezes the Z-axis measurements at the point where the spark is first detected. This allows the Z-axis to be preset for further EDM machining from a known point.

From the EDM display mode, press the [EDGE FIND] key and < FREEZE ON SPARK > menu key.

ADDITIONAL STATE OF THE STATE OF THE SPARK OF STREET

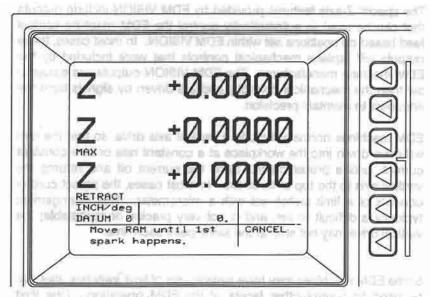


Figure 4-23. "Freeze on first-spark" feature

The status window reports that the "freeze on first-spark" function is selected. When the first-spark condition is sensed, the Z measurement (both the primary, absolute measurement and the secondary, incremental measurement if shown) and the middle Z MAX measurement are frozen at the last measurement, and the message "FROZEN" is shown directly underneath all three displays. The upper menu key changes to < THAW >, and a preset operation is begun, the same as if the Z-axis key had been pressed. Completing the presetting function will remove the "freeze", and return the display to normal EDM operations. The "freeze" on the Z-axis measurements may also be removed by pressing the < THAW > menu key, as with normal DRO presetting operations. Press the Z-axis key to cancel the presetting operation.

DATUM points can be established while in the EDM display mode, as well as the DRO mode. If set within the EDM mode, only the DATUM effects in the Z-axis will be shown; effects on other axes will not be displayed until returning to the DRO display mode. DATUM points can only be set if the EDM outputs are disabled.

DATUM setting operations are the same as those described for the DRO mode. Refer to that section for details.

Using the DATUM setting routine

Controlling EDM

Common Edit control

Hodder.

MGS rittle aretemined

South loan Table a more line outside years must be show

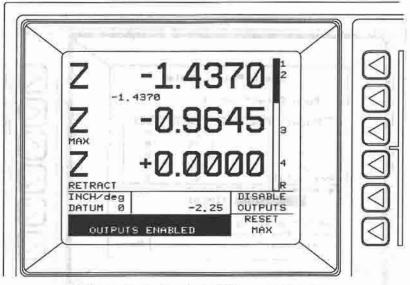


Figure 4-24. Typical EDM mode display

Figure 4-24 illustrates a typical EDM mode display during an EDM operation. Here, the Bar Graph is shown and both incremental and absolute measurements are allowed because of appropriate settings for EDM display format. Note the highlighted message in the status window, "OUTPUTS ENABLED". This indicates that the operator had turned the outputs on with a menu key selection, and the EDM operation is in progress.

Look at the upper menu key. The menu key is labeled "DISABLE OUTPUTS". Pressing the key would turn the control circuits "OFF"; the status window message would change to show a "OUTPUTS DISABLED" message, and the menu key label would change to "ENABLE OUTPUTS". For most installations this would halt the EDM operations, removing power to the ram advance and to the EDM electrode.

alified abuved laiden of our following art in disease.

#### CAUTION

Do not enable the outputs until the operation requires. Depending on the user-installed wiring to the EDM machine controls, the EDM machine may be under power when the outputs are enabled.

Enabling the outputs at an inappropriate time may damage the workpiece or the EDM machine, and may cause injury to the operator.

The EDM VISION outputs work in conjunction with the values set in the SET POINT table. Press the [SET POINT] key, and the < Edit Spark Point Table > menu key (the outputs must be disabled).

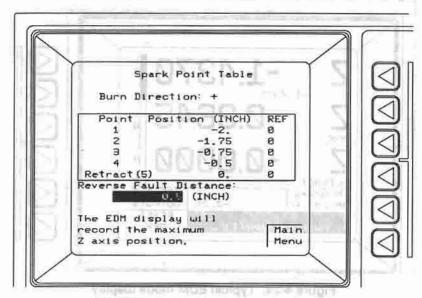


Figure 4-25. Spark Point Table screen

Mari de proció salgela abore MCS ignové a romanili MSA mapel

Figure 4-25 illustrates a typical Spark Point Table, with settings made for all spark points. Setting Spark Points is discussed in detail under the topic "Spark Points" later in this section.

Note that the burn direction has been set as "+"; successive Spark Points in the table must be more-positive than the previous one. All values could have positive, but Spark Point #1 would have to be the smallest value, and the Retract Point (#5) would have to be the largest value in the table. Conversely, if the burn direction is set as "-", successive Spark Points must be smaller (or more-negative) than the previous one, with the Retract Point being the smallest (or most-negative). The Burn Direction setting is independent of the counting direction set for this axis within the setup routine; it may be changed by the operator to suit the current EDM operation.

If Spark Point values are not set in the correct sequence, a warning is shown at the bottom of the Spark Point Table screen: "WARNING: INVALID SPARK TABLE". If the table entries are not corrected before returning to the EDM display mode, an error message is also shown in the status window: "FAULT: Invalid Spark Table, Please correct". The operator is prevented from activating the EDM outputs, as no menu key for enabling the outputs is shown.

Refer again to Figure 4-24. The outputs are enabled. The bar graph on the right side of the display gives a visual representation of the relationship between the current **Z** absolute measurement (the current ram position) and the Spark Point table settings for Spark Points and the Retract Point. Note that the bar on the graph is extended part way down the chart, past the first and second Spark Points. As stated

in the explanation of EDM outputs in <u>Section 1</u>. <u>Installation</u>, the relay contacts for Spark Points #1 and #2 would be closed (in addition to the Retract Point, EDM Valid, and Fault relay contacts).

Also note that the Z and Z<sub>MAX</sub> displays show that the EDM ram had been extended further (Z<sub>MAX</sub>) than its current position (Z). It has been retracted to change or check electrodes, to check the progress of the EDM operation, etc. The distance that the ram has been retracted is less than the "Reverse Fault Distance" set within the <u>Spark Point Table</u> (Figure 4-25), so no fault is shown.

In most cases, the operator will determine and set the Spark Points to work with features provided through connection to the Z-axis outputs. This could provide, for example, a fast cutting rate for the first portion of the burn, then automatically changing the current at preselected points to progress through the burning operation. When the Retract Point is reached, the ram would return to its home position.

#### CAUTION

The machine actions described here are only examples of features that can be accommodated. The action of the EDM machine will depend on the connections made to EDM VISION, EDM machine operations, and outside machine controls installed by the user.

The operator must be thoroughly trained in the operation of the EDM machine with the added controls. Review operators manuals prepared by those who have modified the machine, and understand the machine operations thoroughly.

The workpiece or EDM machine may be damaged or the operator may be injured if the operator does not understand the intended machine operation.

Several "faults" will affect the progress of the EDM operation. These include:

- reverse movement exceeds the Reverse Fault Distance setting
- counting error detected
- internal transmission error detected
- Absolute measurement beyond the Retract Point

Any of these faults will stop the EDM operation (relay outputs are returned to their normal "OFF" state, just as if the < DISABLE OUTPUTS > menu key were pressed) and display a "fault" message. Clear the fault condition and return to normal operation by pressing the appropriate menu keys. Refer to Section 1. Installation for additional details about fault conditions and control actions.

**EDM VISION** 

Flantunes that

distribus.

# Features that replace the DRO and EDM mode displays

Several features take over the entire display area, rather than just modifying the display. All of these features are accessed with a single key. All except the on-screen help feature are deactivated by pressing the [DRO/EDM] key; the help feature is deactivated by pressing a menu key.

total university of the Edward from the compete costsion (2). It has been

Full-screen features include the calculator, accessed with the [CALC] key; the system setup routine [SET SYS]; the hole pattern feature [HOLE PTRN]; the point setting routine [SET POINT]; and the on-screen help feature [HELP].

## CALC: using the calculator

EDM VISION provides a built-in calculator to assist with calculations required while positioning or performing EDM operations. This feature allows access to an eight-digit, four-function calculator. Results from a calculation can be used as an input for presetting operations. The operator can use the calculator built into EDM VISION rather than a separate calculator.

In addition, the calculator feature allows tapers to be measured or calculated.

in machine a choral during the wife the fire to date of

#### Four-function calculator

From the DRO or EDM display mode, press the [ CALC ] key. The current measuring display is replaced by the <u>STANDARD CALCULATOR</u> screen.

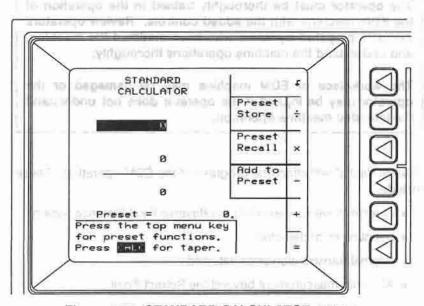


Figure 4-26, STANDARD CALCULATOR screen

To use the calculator:

Enter a number with the number keys

- Press a menu key corresponding to the operation to be performed (divide, multiply, subtract, or add)
- 3 Enter a second number for the operation
- Press the < = > menu key to display the results

A numerical entry can be re-started by pressing the [CLEAR] key.

Press the [CLEAR] key twice to clear the current calculation and begin again.

The calculator can be accessed at any time, including while using another full-screen feature. However, it cannot be accessed while the help feature is active. Return to normal measuring operations by pressing the [ DRO/EDM ] key.

The preset calculator allows the results from the four-function calculator to be stored as the current preset, added to the current preset, or for the current preset to be recalled for use in a new calculation.

From the DRO or EDM display mode, press the [ CALC ] key. There are two sets of menu keys provided for the calculator feature. The standard four calculator functions are highlighted, showing that they are currently active; the left-hand menu items are dimmed. An arrow at the top of the menu key block also indicates the set of menu keys that are currently active.

Press the top-most menu key (corresponding to the location of the arrow) to activate the other menu. The right-hand menu keys are dimmed, and the left-hand menu items become highlighted; the arrow now shows the left-hand column menus as being active.

The menus in the left-hand column indicate presetting operations that can be done with the calculator. These include storing a calculation to the preset register; recalling the current preset register; and adding to the current preset value. Storing a new preset or adding to the current preset will change the value in the preset register for the DRO and EDM display modes.

To recall the current preset value for use in a calculation, press the top-most (arrow) menu key, then the < Preset Recall > menu key.

The current value for the preset is placed in the top entry block on the calculation table. The menu highlight and indicator arrow revert to indicating that the four calculator functions are currently active. Proceed with a calculation by selecting an operation, entering a number, and finding the result.

The result of a calculation may be saved to the preset register. After completing a calculation, press the top-most (arrow) menu key to select preset functions, then press the < Preset Store > menu key.

Preset calculator

The results of a calculation may be used to increase the value of the preset. After completing a calculation, press the top-most (arrow) key to select preset functions, then press the < Add to Preset > menu key. The value of the preset is increased by the results of the calculation. Return to normal measuring operations by pressing the [ DRO/EDM ] key.

### Taper calculator

The taper calculator can calculate the angle of a two-axis taper either by moving to points along the taper or by entering dimensions. To use the calculator:

From the DRO or EDM display mode, press the [CALC] key twice.

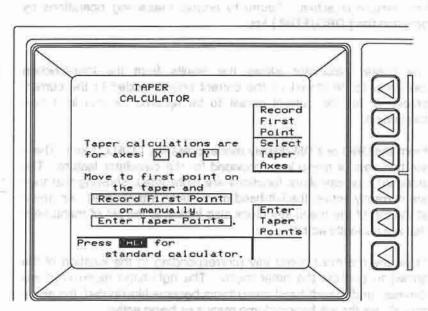


Figure 4-27. TAPER CALCULATOR screen

NOT THE REPORT OF THE PARTY OF

- Select the axes for the taper calculation. The current selection of axes are shown on the display. If necessary, select the axes along which the taper runs by pressing the < Select Taper Axes > menu key, then pressing two of the axis keys (X, Y, Z, or W).
- Record or enter points manually. To record points:
- Install the Edge Finder and move the machine table so that the Edge Finder touches one point along the taper. Use the Edge Finder Probe in the manual mode (watch for the lamp to be lit) or use another means to detect contact between the electrode and the workpiece, and press the < Record First Point > menu key.

Move the table so that the Edge Finder touches a second point along the taper, then press the < Record Second Point > menu key.

THE RESIDENCE OF A SHARE STREET WAS TO SEE THE

To enter points:

To compute a taper based on dimensions: press the < Enter Taper Points > menu key.

MULE AND RESIDENCE PROPERTY OF THE SECOND SE

- Use the number, [.], [+/-], [CLEAR], and cursorcontrol (arrow) keys to enter coordinates for two points along the taper.
- Press the < Compute Taper > menu key.
- EDM VISION will calculate both the smaller angle and the complimentary angle (90° minus the smaller angle) along the taper. The angles are reported in both decimal degrees and degrees-minutes-seconds format.

Return to normal measuring operations by pressing the [ DRO/EDM ] key.

The parameter setting feature is accessed by pressing the [SET SYS] key. The parameter setting methods are covered in Section 3. SET SYS: EDM VISION setup operations. Refer to that section for details.

SET SYS: using the parameter setting feature

Press the [ DRO/EDM ] display mode key to save the current settings and return to measuring operations.

Some of the parameter setting operations require that the current operation be completed or cancelled before quitting the parameter setting routine. An "INCORRECT KEYPRESS" message is briefly shown. Complete or cancel the operation with a menu key, then press the [ DRO/EDM ] key.

EDM VISION provides a hole pattern routine to assist with locating features that are dimensioned with polar coordinates (an angle and a distance from another feature). This feature eliminates the need to convert dimensions to a rectangular (or Cartesian) coordinate system, a process that commonly leads to errors. The hole pattern feature can greatly reduce the time required to determine the correct location for and to move into position to create features dimensioned with polar coordinates.

Since the hole pattern feature is intended to assist with creating hole patterns in the X-Y plane, it only works in the DRO display mode. If the [HOLE PTRN] key is pressed while in the EDM display mode, an "INCORRECT KEYPRESS" message is displayed.

HOLE PTRN: using the hole pattern feature

The hole pattern is located from the current absolute measurement. Inputs include the number of holes, the radius, a location of the center of the pattern from the current absolute position, and the angular location of the first hole. EDM VISION automatically calculates the location of each hole in the pattern, and presets the X- and Y-axes' incremental measurements. Move the EDM table to zero the X- and Y-axes' incremental measurements; the ram is directly above the location for the feature. After creating the feature, press a menu key to display the presets to locate the next hole and move the table to zero the incremental measurements; the electrode will be in the correct position for the next hole in the pattern.

contract telephone to large appropriate for been points

## Setting the hole pattern

THE PART OF THE PA

KINDS TOWNSON

auf amen tut - 310s

To create a pattern of holes:

From the standard DRO display mode, press the [HOLE PTRN] key.

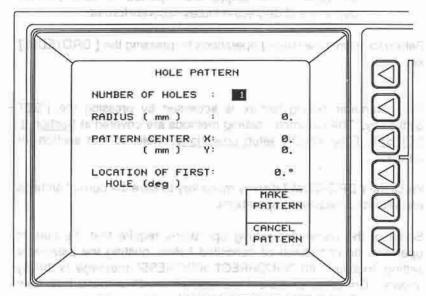


Figure 4-28. HOLE PATTERN screen

The <u>HOLE PATTERN</u> screen replaces the measuring display. Enter information at this screen to establish the pattern of holes or other set of features that are located with polar coordinates. Move the highlighted cursor up and down with the cursor-control keys, and make appropriate settings with the number, [CLEAR], [.], and [+/-] keys. To establish a pattern of holes:

- Enter the number of holes in the pattern. The pattern can be from 1 to 99 holes.
- Enter the radius of the pattern (distance from the center of the pattern to the center of each hole). If necessary, change the measuring units with the [INCH/MM] key.

- Enter the radius of the pattern (distance from the center of the pattern to the center of each hole). If necessary, change the measuring units with the [INCH/MM] key.
- If the center of the pattern is not at the current location, enter the offsets from the current location for both the X and Y directions.

Jaumodiannuos uu douvi anninosi.

Enter the angle for the first hole. This angle must be referenced from the positive X-axis toward the positive Y-axis. The angle may be entered in either decimal degrees or degrees-minutes-seconds notation; press the [DEG/DMS] key to change the angular units if required.

a best statististich med pravera is syttisce

Press the < MAKE PATTERN > menu key.

Producing the hole pattern

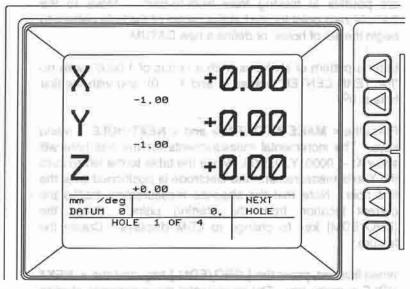


Figure 4-29. DRO display after starting a hole pattern

The display reverts to the DRO display mode. The status window message indicates that a hole pattern operation is underway, and a < NEXT HOLE > menu key is presented. Press this key to begin the pattern.

- The incremental measurements have been preset to reflect the movements required to move the table to the first hole in the series. Move the table to zero the X- and Y-axis incremental measurements. Press the [DRO/EDM] key to activate the EDM display, and EDM the first feature. When the first feature is completed, again press the [DRO/EDM] key to return to the DRO display.
- Press the < NEXT HOLE > menu key. The status window increments the hole number, and the incremental measurements are preset once again.

Repeat steps 7 and 8 as required to complete the pattern of holes. If necessary, the hole pattern function can be cancelled by pressing the [ HOLE PTRN ] key.

After pressing the < **NEXT HOLE** > menu key for the last hole in the pattern, the menu key changes to < **REPEAT PATTERN** >. The pattern may be repeated to produce concentric features at the same locations (such as counterbores).

Eyror, that angles for the first role. This engia must be

When finished, press the [HOLE PTRN] key to cancel the Hole Pattern function and return to normal DRO operations.

As an example of entries, displays, and the movements required for creating a hole pattern:

Paper that c MARCE PATTERN a mean lary

The EDM machine axes are set so that X-axis movements are positive in moving from right-to-left, and Y-axis movements are positive in moving from front-to-back. Move to the DATUM zero point located at the center of the hole pattern to begin the set of holes, or define a new DATUM.

Enter a pattern of six holes, with a radius of 1.0000", with no "PATTERN CENTER" entries (X and Y = 0), and with the first hole at  $0^{\circ}$ .

Press the < MAKE PATTERN > and < NEXT HOLE > menu keys. The incremental measurements for the first hole will show X: -1.0000, Y: 0.0000. Move the table to the left to zero the X-axis measurement; the electrode is positioned over the first hole. Note that the absolute measurement tracks the current location from the starting point. Press the [DRO/EDM] key to change to EDM displays. Create the feature.

When finished, press the [ DRO/EDM ] key, and the < NEXT HOLE > menu key. The incremental measurements change to X: +0.5000, Y: -0.8660. Move the table X-axis in the negative direction to zero the measurement, and move the Y-axis in the positive direction to zero that measurement. The electrode will be positioned directly over the second hole in the series.

The same pattern may be repeated at another location to create multiple patterns of similar features. Return to the normal DRO mode, move to the center of the second pattern and set a new DATUM (or make new "PATTERN CENTER" entries at the <u>HOLE PATTERN</u> screen) to locate the new pattern center. Begin the new pattern by pressing the [HOLE PTRN] key. The prior hole pattern settings remain in effect unless changed; start the second pattern by pressing the < MAKE PATTERN > menu key.

PROPERTY AND ADDRESS OF THE PARTY OF THE PAR

The SET POINT feature allows setting three important kinds of positions: Edge Finder Probe offsets, "Machine Zero"; and "Spark Points". Edge Finder Probe offsets and "Machine Zero" were introduced in the "Edge finding" and "Using the DATUM setting routine" topics relating to the DRO display screens earlier in this section. The following descriptions provide a brief review of these two features. Refer to the appropriate topics for further details.

SET POINT: using the point setting feature

"Spark Points" were briefly discussed in the topic "Using the EDM controls" as they related to the EDM display mode. The discussion below details all features of this important EDM control function.

**Edge Finder offsets** 

The earlier presentation of Edge Finder offsets discussed several methods of using edge finding probes and electrodes to locate features on the workpiece. Refer to that section for complete details on using all of the Edge Finder features. The following review relates specifically to the ACU-RITE Edge Finder Probe.

Establish the offset for the Edge Finder Probe:

From the standard DRO display, press the [SET POINT] key, then the < Edge Finder Offsets > menu key.

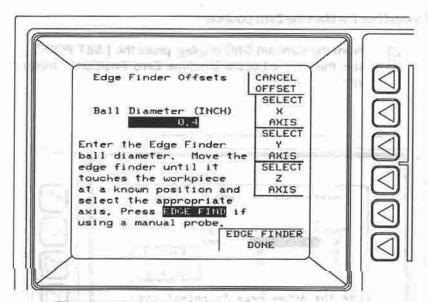


Figure 4-30. <u>Automatic Edge Finder Offsets</u> screen

Enter the ball diameter by using the numeric keys (English ACU-RITE Edge Finder Probes have a 0.400" diameter ball, metric Probes have a 10 mm diameter ball). Make sure that the current measuring units selection matches the type of Probe.

- Move one of the axes so that the Probe just touches a reference edge of the workpiece; a highlighted message, "Edge Finder TOUCHING", appears. Press the appropriate axis key as instructed. Note the measurement shown in the highlighted window; this should correspond to the distance from the current DATUM's zero point to the edge touched (if the edge was the current DATUM's zero point, the dimension will be zero). Press the < Measurement Complete > menu key to establish the offset.
- Do the same for each axis to locate the workpiece in all three axes. When finished, press the < EDGE FINDER DONE > menu key to return to the SET POINT Main Menu.

#### Locate Machine Zero

SET PORTE USED THE DEED

CHARLES BOTTON

A Machine Zero position is established for a fixed point on the EDM machine. This position is used as a reference for physically locating a "home" position, or for locating fixtures from a fixed point on the table. Machine Zero for the Z-axis might be the table surface.

Setting a Home Reference Point, and then establishing a Machine Zero position fixes the relationship between these two locations. All DATUMs are referenced to the Machine Zero position.

To establish the Machine Zero position:

From the standard DRO display, press the [SET POINT] key, then the < Locate Machine Zero Position > menu key.

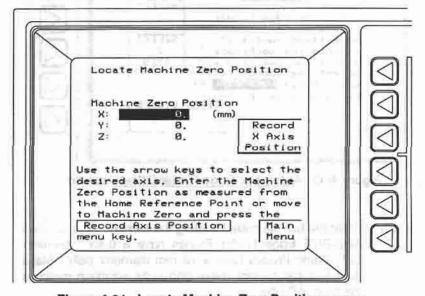


Figure 4-31. Locate Machine Zero Position screen

- If required, set the Home Reference Points for all axes before proceeding.
- Move the highlight up or down on the <u>Locate Machine</u>
  <u>Zero Position</u> screen with the cursor-control keys to select
  an axis. Move the table to the Machine Zero position and
  press the < **Record** \*\* **Axis Position** > menu key, or
  make an entry for the position with the numeric keys.
- Press the < Main Menu > menu key to fix the position, and the [ DRO/EDM ] key to return to normal operations.

and "line" drillion "by grount mellegions A w

Spark points are used to control EDM operations at important Z-axis locations, especially the retract point for the ram. They work in conjunction with the Z-axis controls to provide output signals (in the form of relay contact closures) when Z-axis measurements match (or are less than) these settings.

Spark Points

To establish the Spark Points:

From the standard DRO display, press the [SET POINT] key, then the < Edit Spark Point Table > menu key.

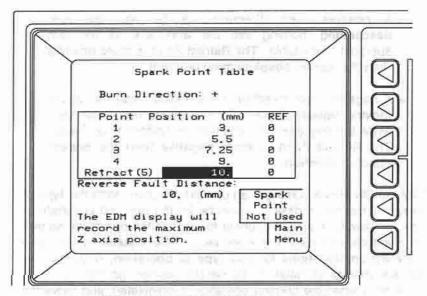


Figure 4-32. Spark Point Table screen

The <u>Spark Point Table</u> allows setting the burn direction; four intermediate Spark Points and a Retract Point; a REF (reference) for each of those points; and a Reverse Fault Distance. Move the highlight around the table with the cursor-control keys to set the parameters. Use the number, [.], [+/-], and [CLEAR] keys to set dimensions for each parameter.

Set the burn direction by pressing the [+/-] key. A positive setting indicates that the current absolute measurement is approaching the retract point from a positive direction. For example:

if the Z-axis counting direction (set as an Axis Parameter with a SET SYS operation) is defined as positive (so that measurements are becoming more positive) while the ram is moving away from the table and toward the ram retract position:

- A negative burn direction will be with the ram descending, burning into the workpiece as the ram approaches the table. The current absolute measurement is more positive than the Retract Point.
- A positive burn direction would indicate that the ram is moving upward, toward the top of the ram movement, while burning (such as creating an undercut, or T-slot).
   The current absolute position is more negative than the Retract Point.

If the Z-axis counting direction is defined as negative while the ram is moving away from the table and toward the ram retract position:

- A positive burn direction will be with the ram descending, burning into the workpiece as the ram approaches the table. The Retract Point is more positive than the current absolute measurement.
- A negative burn direction would indicate that the ram is moving upward, toward the top of the ram movement, while burning (such as creating an undercut, or T-slot). The Retract Point is more negative than the current absolute position.

EDM VISION allows burning in an upward direction. With this type of operation, the action desired would be for the ram and electrode to move downward a small amount at the end of the operation, so that the electrode can clear the workpiece. The installer must have made accommodations for this type of operation; otherwise the ram will attempt to return to its retract position (at the top of its movement) when the burning operation is completed, and move the electrode into the workpiece.

#### CAUTION

Before setting up an operation that will burn towards the ram "home" position, make sure that the machine controls will support this type of operation.

If this type of operation is not supported, the operator could be injured. The electrode, workpiece, or EDM machine could be damaged.

Set intermediate Spark Points 1-4, the Retract Point, and their references with the numeric keys. Clear a Spark Point setting with the < Spark Point Not Used > setting Spark and Retract Point settings correspond to Z absolute measurements as the ram moves during EDM operations. These settings must be sequential, and must follow the Burn Direction setting.

EDM machines usually use a vertical ram; with this arrangement, the first Spark Point would represent a location within the workpiece (below the top of the workpiece). Spark Point 2 would be further into the workpiece, etc.; the Retract Point represents the lowest level within the workpiece, where the EDM burning operation is complete.

The Spark Points can be set explicitly, with a specific dimension for each. Or, they may be referenced to one another with REF settings. If using REF points, at least one REF point must be zero. REF points cannot be a circular reference (they cannot be set for that Spark Point; Spark Point 4 cannot have a REF setting of 4); REF points must refer to an existing Spark Point; the Spark Point and REF settings must maintain the sequence of advancing or retreating settings.

For example, either of the following two Spark Point Tables will yield the same results:

List 1878 YEA I into primo this posts following paying disk

	Burn Direction: +	
Point	Position (INCH)	REF
1	-1.	0
2	-0.75	0
3	-0.5	0
4	-0.25	0
Retract	(5) 0.	0

	Burn Direction: +	
Point	Position (INCH)	REF
1	-1.	0
2	0.25	1
3	0.25	2
4	-0.25	5
Retract	(5) 0.	0

Regardless of setting method, all settings must be in sequence, and must follow the counting and Burn Direction settings. For example:

if the counting direction and burn direction settings are such that: the top of the workpiece is more-positive than the Retract Point; the burn begins at the top of the workpiece and progresses toward the bottom of the workpiece; then each successive Spark Point must be more-negative than the last.

- if the counting direction and burn direction settings are such that: the top of the workpiece is more-negative than the Retract Point; the burn begins at the top of the workpiece and progresses toward the bottom of the workpiece; then each successive Spark Point must be more-positive than the last.
- if the counting direction and burn direction settings are such that: the top of the workpiece is more-positive than the Retract Point; the burn begins below the top of the workpiece and progresses toward the top of the workpiece; then each successive Spark Point must be more-positive than the last.
- if the counting direction and burn direction settings are such that: the top of the workpiece is more-negative than the Retract Point; the burn begins below the top of the workpiece and progresses toward the top of the workpiece; then each successive Spark Point must be more-negative than the last.



Set the Reverse Fault Distance.

The Reverse Fault Distance sets a limit on the distance that the ram may retreat from its closest approach to the Retract Point, before a fault is declared. When properly wired to the machine controls, the fault signal will normally halt further automatic EDM operations until the system is reset. This is a common safety feature to prevent the ram from retracting completely from the workpiece while under power, which may cause a spark above the work tank and present a danger from fire.

When finished, press the < Main Menu > menu key to return to the <u>SET POINT Main Menu</u> screen, or the [DRO/EDM] key to return to normal measuring operations.

Note that when the bar graph is activated for the EDM display mode (with an axis parameter setting after pressing the [SET SYS] key), the relationship between the Spark Points and the Retract Point, as well as the current absolute position (when it is within the range of the Spark Points), are shown graphically on the bar graph. As the Z absolute measurement enters the zone defined by the Spark Points, the bar descends from the top of the display. Relative positions for the Spark Points are indicated on the side of the bar graph.

rapping and appropriate their little particles in the highest

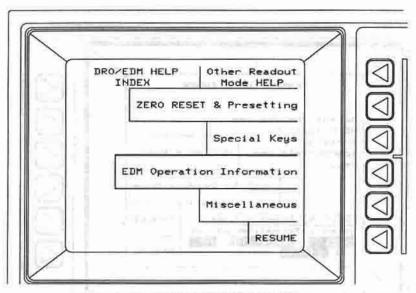


Figure 4-33. DRO/EDM HELP INDEX screen

DESCRIPTION OF THE PROPERTY OF

The HELP screen displayed offers topics of information about aspects of DRO measuring operations, which are accessed by pressing the appropriate menu keys.

The above screen presents DRO information, because the [HELP] key was pressed while in the DRO mode with no other operations started. HELP screens and menus are "context-sensitive"; the display and topics shown depend on current operations. For example: if in DRO mode and the [DATUM] key has been pressed, the screen presents information about DATUM operations.

Pressing the [HELP] key once again presents a <u>GENERAL HELP</u> INDEX screen.

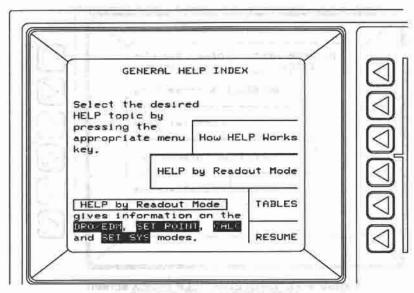


Figure 4-34. GENERAL HELP INDEX screen

This screen provides access to HELP information on any topic. Note that the same information on DATUM operations presented with the earlier example can be accessed through the <u>GENERAL HELP INDEX</u> screen, but several menu keys would need to be pressed to get to the same point.

Press the < RESUME > menu key to return to the last operation.

## Saving settings

All current settings and measurements are retained while EDM VISION is "sleeping".

Current measurements and reference point locations are lost whenever power to EDM VISION is interrupted. The last position cannot be restored; however, the Machine Zero and all DATUM positions will be restored by finding the reference marks on each encoder.

Current settings that are in effect, both those that were set with the parameter setting routine or with the keyboard, are saved and will be in effect after turning EDM VISION power off and then re-applying power. If an operation that would set parameters is started, but not completed, the settings are lost. The display will always start at the DRO display, rather than at the screen that was shown at the time power was lost.

The only setting that is not retained is the current DATUM selection; when power is returned, EDM VISION always reverts to DATUM 0.

## Section 5. Accessories

EDM VISION offers several accessories that complement and enhance the basic features. These include the VISION Edge Finder Probe, VISION 2-Axis Modules, VISION CFI Module, VISION Option Module, VISION Foot Switch, Parallel Printer, and Storage device (external computer). Modules may be installed in any of the three slots in the rear of EDM VISION; however, the standard EDM VISION configuration has two of the slots filled (with a 2-Axis Module, and a CFI Module). Your ACU-RITE Distributor carries a complete line of VISION accessories to complete your EDM VISION measuring and control system, making it even more productive.

## Introduction

The ACU-RITE First-Spark Detector accessory is made specifically for use with EDM VISION and EDM machines. It provides a more-accurate means of establishing the workpiece / EDM electrode relationship, and is much faster than using traditional methods for setup.

The prepared they be bringed, and the Delector of EDM YISKITI

First-Spark Detector

An internal jumper is provided to allow the First-Spark Detector to be used with virtually all EDM machines. The jumper sets the internal circuitry for use with either high- or low-voltage EDM power supplies.

determined and an external experienced an electrical and threat an electrical

how works and administration upon the most time of a replical prints and

primare of the mineral primary to at a second of a gift of a first primary of the primary of the

A THE REAL PROPERTY AND A PROPERTY OF THE PROP

High-voltage circuits are:

90 to 300 VDC, either polarity 90 to 300 VAC

Low-voltage circuits are:

50 to 150 VDC, either polarity 50 to 150 VAC

The First-Spark Detector is supplied with the jumper in the high-voltage position. If using the unit with a low-voltage circuit, remove the cover and move the jumper. Figure 5-1 shows the location of the jumper.

#### CAUTION

Make certain that power to the EDM electrode holder is turned off before installing the First-Spark Detector, or before removing the cover of the First-Spark Detector to set the voltage-select jumper. Do not turn the power on again until the mounting is complete or the cover has been reinstalled. The operator may be injured, and the Detector or EDM VISION may be damaged.

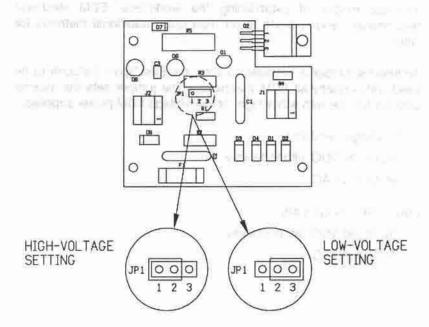


Figure 5-1. High/low voltage select jumper location

#### CAUTION

The jumper must be set into the proper location for the normal range of voltage used with the EDM machine. An improper setting could damage the First-Spark Detector.

If the cover is removed to set the jumper, make sure that the cover is re-installed and the screws evenly tightened to re-seal the unit. Failure to seal the unit may allow fluids to enter and short out the internal electronics.

The First-Spark Detector accessory should be permanently mounted near the EDM machine ram, in a location that will provide sufficient

introduction

First-Spark

cable slack to allow full movement of the ram and not interfere with other machine components. If necessary, install wire ties to capture the cable to keep it out of the way of normal operations.

The ACL MTE Edge Flader Probe comes exclassed with a strongs

The First-Spark Detector accessory is equipped with two sets of leads for connection to the EDM machine and to EDM VISION. The shorter lead set must be connected to the electrode and workpiece, to sense the first-spark condition. The longer lead must be connected to terminals on the Z-axis CFI connector. Refer to Appendix D in Section 6. Appendices for information about connections to the CFI receptacle.

Refer to the Installation Instructions provided with the First-Spark Detector for additional installation information.

t album and send marchine who much it

The First-Spark Detector accessory works with the [EDGE FIND] key, only in the EDM display mode. It is disabled in the DRO display mode. In this way, the operator may use the Edge Finder Probe or a contact-sensing circuit in combination with an electrode for positioning and measuring in the DRO display mode, and the First-Spark Detector in combination with an electrode in the EDM display mode. It may be used to measure distances, locate an edge, and zero the display based on sensing an edge of the workpiece. The First-Spark Detector, when activated, sends a signal to EDM VISION to "freeze" or to zero a pre-selected axis measurement when the edge is sensed.

#### CAUTION

The Probe EDM VORUN, the EDM starture, of the workness

Power must be supplied to the EDM electrode and workpiece while using the First-Spark Detector. Do not touch the electrode, workpiece, or wire connections while under power. The operator may be injured.

A complete description of procedures for working with the First-Spark Detector is given in <u>Section 4</u>. <u>EDM operations</u>.

The ACU-RITE Edge Finder Probe is used to detect the edge of a workpiece during setup on an EDM machine. This can make the workpiece setup much more accurate, and is much faster than using traditional methods for setup. The Edge Finder Probe is intended to be used with the edge-finding routines accessed with the [EDGE FIND] key.

The Edge Finder is intended to be used with electrically-conductive workpieces, that provide a ground path back to EDM VISION. This arrangement allows use of automatic sensing of the contact between the Edge Finder and the workpiece.

For non-conductive workpieces or other situations where the contactsensing cable cannot be used, the Edge Finder Probe provides a visual indication (a lighted lamp) of contact between the Probe and

COLDY, LOCAL PER VAN SIMOLON OF Officer to case wover on release his

## **Edge Finder Probe**

the workpiece. Manual entries can be made to EDM VISION to signal the location of this contact.

The ACU-RITE Edge Finder Probe comes equipped with a storage case, batteries, a cable, and a small vial of light oil. Remove the Probe, unscrew the cap at the top, and install the batteries. Replace the cap.

Like many tools and machine instruments, the Probe is made from high-quality steel, and will oxidize if not protected. Use the oil provided to lightly coat the outside of the Probe to prevent oxidation. The Probe should be wiped down with a light oil periodically to prevent oxidation.

Install the Edge Finder Probe in the EDM machine electrode holder. The English version of the Probe has a 0.750" body diameter; the metric version has a 20 mm body diameter. If the EDM machine is equipped with a quick-change tool holder, it is recommended that the Probe be installed in its own tool holder and preset like all other tools used on the machine.

#### CAUTION

Never turn the EDM machine's power on while installing or using the Edge Finder Probe. The operator may be injured. The Probe, EDM VISION, the EDM machine, or the workpiece may also be damaged.

Connect the Probe to EDM VISION with the supplied cable. The cable clips onto the groove at the bottom of the Probe. Remove the plastic hole plug on the back of the EDM VISION CPU Module (or the Option Module, if installed) and insert the connector at the opposite end of the Probe cable.

#### CAUTION

If an Option Module has been installed, the Edge Finder must be plugged into the Option Module rather than the CPU Module. The CPU Module receptacle must be disabled by moving a jumper. Failure to set the jumper may damage the CPU Module or Option Module. Refer to "Installing / removing modules" in Section 1. Installation for instructions on setting the jumper.

Before using the Probe, the ball diameter must be established within EDM VISION, to define the amount of offset to use when an edge is found. This procedure is given in <u>Section 4</u>. <u>EDM operations</u>.

# EDM VISION

Edge Finder Probe

The Edge Finder Probe works with the [ EDGE FIND ] key. It may be used to measure distances, locate an edge, and zero the display based on sensing the edge. The Edge Finder, when activated, sends a signal to EDM VISION to "freeze" or to zero a pre-selected axis measurement when the edge is sensed. Procedures for working with the Edge Finder Probe are also given in Section 4. EDM operations.

change operating conditions, etc.

stance make or purpose

EDM VISION is equipped with one VISION 2-Axis Module and one VISION CFI Module. One additional 2-Axis Module can be installed in the available slot on the rear. Refer to Section 1. Installation for instructions on installing an additional VISION 2-Axis Module.

## VISION 2-Axis Module

#### CAUTION

Power must be removed from EDM VISION prior to installing or removing Modules. Leaving power on while installing Modules may damage the Module or EDM VISION

The factory-installed 2-Axis Module and CFI Module provide inputs for up to three encoders. EDM VISION can display a maximum of four measuring displays at once. With the installation of an additional 2-Axis Module, more encoder inputs are available than can be displayed at once. One additional encoder can be connected to one of the encoder receptacles on the newly-installed 2-Axis Module, and assigned the axis label that is not yet used to enable a measuring display for that axis. If an encoder is attached to the second additional axis, axis labels must be reassigned to permit a display. Any of the four axes that are currently set for display may be disabled (the label removed), and that label assigned to the fifth axis so that encoder's movements can be displayed. Note that if the Z-axis label is reassigned, the special EDM VISION features normally available on the Z-axis (the CFI outputs) will not operate and the EDM display mode will be inoperative.

Axis labels and other encoder information must be set for the newly-installed encoders; use the parameter setting routine accessed by pressing the [SET SYS] key. Refer to Section 3. SET SYS: EDM VISION setup operations for instructions on labeling axes, setting axis (encoder) parameters, and selecting axes for display.

EDM VISION is equipped with one VISION CFI (Control Function Interface) Module. EDM VISION works with this module to provide the special EDM features described in <u>Section 4</u>. EDM operations.

Abhort wiff for seaven our physics our \$2AVEFVE LOF

An additional VISION CFI Module can be installed in the open slot on the back. Up to two additional VISION CFI Modules (for a total of three) could be installed in EDM VISION (the third CFI Module would replace the installed VISION 2-Axis Module). These additional CFI Modules would not provide the special EDM features, but would allow normal CFI controls to work on those axes.

## VISION CFI Module

All VISION CFI Modules work with a single encoder input per Module. Output signals, in the form of (relay) contact closures, are provided for measurement-matching conditions and for control signals. In general, when the incremental measurement for the axis is less than a preset dimension, the relay contacts will close; external controls can then act on that signal to slow automatic travel, turn around, brake, change operating conditions, etc.

Section 4. EDM operations in this manual described in detail the special EDM features performed by the CFI Module that is labeled as the Z-axis. These features are associated with the assignment of the Z-axis label to a CFI Module. If a second CFI Module is installed, and the Z-axis label is assigned to the new Module, the new Module would perform those special functions. Outputs for the Z-axis CFI include EDM Outputs Enable, Fault, and five comparative functions: within Spark Points #1 through #4, and equal to Retract Point. All comparative outputs are driven by the absolute measurement for the Z-axis. All comparative outputs are single-ended (the Spark Points and Retract Point must be in sequence and must reflect the Burn Direction setting). All comparative outputs may be selected as steady-state, or pulsed.

CFI Modules that are assigned axis labels other than Z will perform the normal CFI functions. Outputs include CFI Outputs Enable, Fault, and five comparative functions: within boundary #1, within boundary #2, greater than zero, equal to zero, and less than zero. The boundary values are double-ended (the boundary value is an absolute value; the output is active whenever the absolute value of the measurement is less than the boundary value). All comparative outputs for non- Z-axis CFI Modules are driven by the incremental measurements. Of the three zero comparisons, only one of the three are active at any one time. All comparative outputs are steady-state. A detailed description of the normal CFI outputs is given below.

To install an additional VISION CFI Module in EDM VISION and connect the encoder, refer to Section 1. Installation.

#### CAUTION

Power must be removed from EDM VISION prior to installing or removing Modules. Leaving power on while installing Modules may damage the Module or EDM VISION.

A connector is supplied with the CFI Module for attachment to the CONTROL INTERFACE receptacle on the rear of the module. The connector provides easy installation by simply inserting wires into the connector block and tightening the appropriate screw. If required, a replacement connector assembly may be obtained from your ACU-RITE distributor or OEM, or from the ACU-RITE Service Center; order part number 387830-804.

MISION CE

Module

VISION 2-Axis

Module

Seven sets of two-wire outputs are provided as detailed in Table 5-1 below. Each set of two connections leads to a normally-open relay contact within the CFI module. Conditions for contact closure are detailed below. Specifications for the contacts are given in Table 6-6, Appendix D in Section 6. Appendices.

#### CAUTION

HE DOOR F. H. HERSE SHEATHOOD BID W.

Be sure that all connections to the CFI Module connector do not exceed the limitations shown in Table 6-6. Exceeding specified limits or improper connections may result in damage to EDM VISION, the CFI Module, or external equipment.

Table 5-1. Pin-outs for CFI Module connectors

Ve cost of secto IRO' piptive from coleum laborations

Connector position	Function Street Color Co	
na righted flu	No connection	
3 (Libum4 Gni - 11)	CFI Outputs Enable	
5 6	Incremental measurement within "CFI Close to Zero #1" boundary	
8	Incremental measurement within "CFI Close to Zero #2" boundary	
9	Incremental measurement > 0	
11 12	Incremental measurement < 0	
13 13 13 13 13 13 13 13 13 13 13 13 13 1	Incremental measurement = 0	
15 16	sus Fault no and done below in	

Axis labels assignments and other encoder parameters are set with the parameter setting routine accessed by pressing the [SET SYS] key. Refer to Section 3. SET SYS: EDM VISION setup operations for detailed information about making appropriate settings. One of the installed CFI Modules must be labeled for the Z-axis, so that the EDM and CFI outputs can be activated. Boundary values are also set with the SET SYS routine; boundary values are an additional axis parameter for non- Z-axis CFI axes. Boundary values are entered by moving the highlight over this characteristic with the cursor-control keys and using the number keys.

Classics Outfluts a ment for Majoritist talp activities to both.
 Committee of models of week pay additional Cell modules. The modules was been dead to a condition on the followised.

Fight in the control to the control of the control

Output signals from the CFI Module include:

- Incremental measurement within "CFI Close to Zero #1" boundary. When the absolute value of the incremental measurement is less than the boundary value, and the Fault contacts are closed, the "CFI Close to Zero #1" contacts are closed. For example: if the boundary value is 1 and the current incremental measurement is less than (a larger negative number than) -1.0000, the contacts first close when the incremental measurement is one encoder count less than the absolute value of -1.0000 (such as -0.9995, if the encoder resolution is 0.0005). The contacts remain closed until the incremental measurement increases to +1.0000. Boundary values are established as absolute measurements; the [+/-] key is not active while setting boundary values.
- Incremental measurement within "CFI Close to Zero #2" boundary. Similar to boundary #1. The boundary values are independent; boundary value 2 may be greater or less than boundary value number 1.
- Incremental measurement > 0. When the incremental measurement is greater than zero and the Fault contacts are closed, the "Incremental measurement > 0" contacts are closed.
- Incremental measurement < 0. When the incremental measurement is less than zero and the Fault contacts are closed, the "Incremental measurement < 0" contacts are closed.
- Incremental measurement = 0. The contacts are closed only when the incremental measurement is equal to zero and the Fault contacts are closed.
  - Note that only one of the above three zero-comparative signals are active at any time.
- Fault. The fault contacts are closed when the outputs are enabled, there is no fault condition, and the CFI Output Valid contacts are closed. When a fault occurs or the outputs are disabled, the contacts open. All comparative signals are disabled when the contacts are open. Fault conditions include:
  - a. encoder input (counting) errors
  - b. Internal hardware errors
  - c. internal software errors
- CFI Output Valid. The CFI Output Valid contacts are closed whenever EDM VISION is in the DRO or EDM display mode, and no fault is present. Selecting any full-screen application opens the contacts.

All installed CFI Modules, including the one used for the Z-axis, are activated by switching to the EDM display mode and pressing the < ENABLE OUTPUTS > menu key. Note that this activates both the Z-axis CFI module as well any additional CFI modules. The installer must make certain that this condition can be tolerated

with the machine controls. Return to the DRO display mode to monitor the progress of the non- Z-axes. All CFI comparative output signals are disabled by again returning to the EDM display mode and pressing the < DISABLE OUTPUTS > menu key. All full-screen applications, including the HELP screens, are locked out when the outputs are enabled.

Refer to the Reference Manual supplied with the VISION CFI Module for additional information and tips on how to use the CFI Module.

A VISION Option Module may be installed in the open slot on the back of EDM VISION. This module can be used to communicate with printers, external computers, and other serial communications devices; and allows use of the ACU-RITE Foot Switch accessory and an external monitor. Only one Option Module may be used on EDM VISION.

To install a VISION Option Module in EDM VISION refer to Section 1. Installation.

#### CAUTION

Power must be removed from EDM VISION prior to installing or removing Modules. Leaving power on while installing Modules may damage the Modules or EDM VISION.

Electrical Misler Option Modelik Receptable

William Title Middley Through and the TOOK FOUR PROPERTY (see apparent

of any Edge Einder Proby is stand, the Edge Einder order her pupping only up VALOTA Dealer Macros, retains their mid for CPU Voltage A pumper on the CPU Morata Fund or netwed for a stands the edge Tester verticities. Eathorn to disease the CPU Module 1990B FRIDER\* receptains may humage the CPU.

purch noted William sit 5 Juniori

VISION Option Module

pidge linter rysoptacle

Frigothe on Option Moorne. Here' to instauring a transport modelles in Settlick I, but alrefore for instructions on securing a pursper.

Fig. 10 postero 1, tellulation or at accumo about practing the but for more mediate on the Orld Module.

Refer to <u>Section 6</u>. <u>Appendix</u> for a description of the individual connectors and connections required to work with specific equipment. That section also contains specifications for the electrical characteristics.

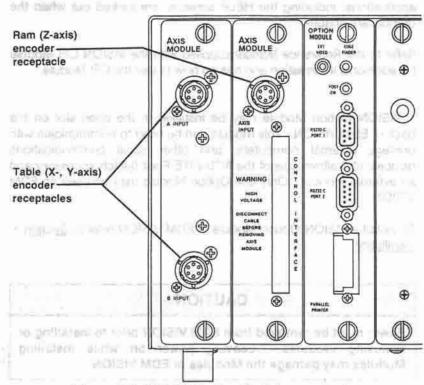


Figure 5-2. VISION Option Module receptacles

## Edge finder receptacle

VISION Option Module

There is an "EDGE FINDER" receptacle on the back of the EDM VISION CPU Module. There is also an "EDGE FINDER" receptacle on the back of the VISION Option Module.

#### CAUTION

If an Edge Finder Probe is used, the Edge Finder must be plugged into the VISION Option Module, rather than into the CPU Module. A jumper on the CPU Module must be moved to disable its edge finder receptacle. Failure to disable the CPU Module "EDGE FINDER" receptacle may damage the CPU Module or Option Module. Refer to "Installing / removing modules" in Section 1. Installation for instructions on setting the jumper.

Refer to <u>Section 1. Installation</u> for information about disabling the Edge Finder receptacle on the CPU Module.

The foot switch receptacle on the rear of the VISION Option Module is intended for use with the ACU-RITE Foot Switch. Insert the connector on the Foot Switch cable into the "FOOT SW" receptacle.

Foot switch receptacle

The Foot Switch can be used with EDM VISION to activate a printer. The action is the same as if the [ PRINT ] key were pressed.

Parameter settings must be made with the system parameter setting routine (accessed with the [SET SYS] key) before the Foot Switch can be used. Refer to Section 3. SET SYS: EDM VISION setup operations for setup procedures.

Parallel printer port

The "PARALLEL PRINTER" receptacle (port) on the rear of the VISION Option Module is intended for use with the ACU-RITE Parallel Printer accessory. The Printer is supplied with a cable for connection between the Printer and the Option Module.

The Option Module will work with most parallel printers. A separate cable assembly may be purchased to connect another manufacturer's printer to the Option Module; order part number 388000-104.

Parameter settings must be made so that the output from the parallel port is compatible to the attached printer. These settings are explained in <u>Section 3</u>. <u>SET SYS: EDM VISION setup operations</u>. Refer to that section for instructions on how to make the settings. Refer to the Operators Manual supplied with the printer for the required settings. For the ACU-RITE Parallel Printer, the settings must be:

Parallel Status:

ON to enable printing

Output Tail:

zero to nine

LF after CR:

NO

Printer Size:

< 40 (less than 40 columns)

Two RS232-C serial ports are provided with the VISION Option Module. They may be used with any serial communications device that conforms to the RS232-C standard, with either single- or bi-directional communications. The ports can work with most serial printers and computers, and will work with the ACU-RITE Storage device (Toshiba laptop external computer).

The RS232-C devices most commonly used with EDM VISION are printers and computers. Printers can only receive information from EDM VISION; no mechanism is provided for controlling EDM VISION, other than delaying additional printing if the printer is busy. Printing information is sent from EDM VISION to the printer whenever the [PRINT] key is pressed.

Computers can both send information to EDM VISION as well as receive information from EDM VISION. The computer can be used as an external, remote controller for EDM VISION. Any function that can be accomplished with pressing keys on EDM VISION can be activated by signals sent from an external computer. Any information that can

RS232-C serial ports 1 and 2

EDM VISION

MGS of Mabiginging

be displayed on EDM VISION screens can be sent to the external

This allows an external computer to monitor operations, or to control operations based on sophisticated programming. Most often, the operator would write a program that would control all facets of the EDM machine operation, using signals to and from EDM VISION to monitor position and ram control information. These programs could be saved and used again for repetitive jobs. In addition, requesting and receiving data from EDM VISION would allow the external computer to perform sophisticated analysis for SPC, process capability studies, etc.

Refer to Section 6. Appendix for a description of the connectors and connections required. If using the ACU-RITE Storage device, connect the supplied cable into one of the ports.

Settings must be made within the parameter setting routine for the external device to work with EDM VISION. These settings are explained in Section 3. SET SYS: EDM VISION setup operations. Refer to that section for instructions on how to make the settings.

Many RS232-C devices also have parameters that can be set to several values. Make sure that settings for the external device and for EDM VISION are compatible. Refer to the Reference Manual supplied with the external device for the appropriate settings. For EDM VISION to work with the ACU-RITE Storage device, the settings must be: where we will have all the book a first

#### RS232-C Functions:

Port Function:

Comp (computer)

Output Tail: LF after CR: 0 to 9

NO

Printer Size: >=40 (40 characters or more width)

#### RS232-C Protocols:

Baud Rate: 1200

None

Data Bits: 7

XON-XOFF:

Inactive

### Sending data to EDM VISION

Foot invitety raceptagle

Parellet printer port

Data sent to EDM VISION is in the form of individual keystrokes, as if the keys on the front of the readout were pressed individually. Each command must be preceded by a "%", ended with a <CR> (carriage return, or ENTER key), and all alpha commands must be uppercase. For example, to use a remote keyboard command in place of pressing the front panel "X" key, send "%Q < CR > ". To preset the Y-axis incremental measurement by 4.25, send the command "%4.25QI<CR>"; or individually as "%4.25<CR>", "%Q<CR>", and "%I<CR>". Table 5-2 gives a complete listing of all ASCII keyboard equivalents to EDM VISION keys.

Table 5-2. Front panel keys vs. external ASCII keyboard characters

EDM VISION keypad	ASCII keyboard equivalent	EDM VISION keypad	ASCII keyboard equivalent	
Menu #1	A CE (TACE) 1.1	REF	dry ou edition o	
Menu #2	S of Samura	INCR	MANUAL NOT DRIV	
Menu #3	D	ABS	0	
Menu #4	F	CLEAR	Jos vice.	
Menu #5	G	The second second	- Ment June	
Menu #6	н	INCH/MM	Z	
* II X D		DEG/DMS	X	
X	Q	SET SYS	* (asterisk)	
Y	w	DATUM	M	
Z	E	SET POINT	\$ (dollar)	
W	B of the	Page 12" cines	Jurgest a MOR.	
Zero Reset	Y and to open to	EDGE FIND	J	
MINA MONTY	tight so each soil	PRINT	K	
0	0	HOLE PTRN	C	
1	1	CALC	% (percent)	
2	2	ORD IND	COPY CONE	
3	3	HELP	! (exclamation)	
4	4		- 40 PTZATE	
5	5	Down arrow	/ (fwd. slash)	
6	6	Up arrow	[ (left brkt.)	
7	7	Left arrow	; (semi-colon)	
8	8	Right arrow	, (comma)	
9	9	THE STREET, SALES	principal principal and princi	
. (dec. point) +/-	. (dec. point) - (minus)	DRO/EDM	@	

swertedgin a in imaging trace in a griffing of souther Methods (All property)

HELP 1	DRO 2 @	3 #	ET POINT 4 \$	CALC 5 %	6 ^	7 &	SET SYS	9 (		)	. +
1	2	3	4 V	5	6 EAR ZERO	7 DESET 0	8 EF I	9 NCR	ABS	)	- =
C		Z E					U .	1	0	Р	Ţ
	M1	M2	M3	M4	M5	Mß	EDGE FIN	D PRINT			< >
, hó	A	S	D	F	G	Н	J	K			. '
	INCH/	MM DEG/E	MSHOLE	PTRN			(0)	MUT			٧
	Z	X	С.	, v	/ 1	В	N	м	*		1

Figure 5-3. EDM VISION keypad function keys mapped to an ASCII keyboard

**EDM VISION** 

Sanding data with compular

LUS commands

#### Sending data with computer DOS commands

DOS commands can be used to set up communications and send commands to EDM VISION, as if the computer were a remote keyboard. Use the DOS command:

MODE COM1:1200,n,7,1 < CR >

to set the computer's RS232-C port 1 (COM1) to the same settings as used for EDM VISION. Send commands to EDM VISION with the DOS commands:

COPY CON COM1 < CR>

%@<CR>

^Z<CR>

which will mimic pressing the DRO/EDM display mode key on EDM VISION's keypad. The "^Z" character is produced by holding down the CONTROL key while pressing the Z key. That character is required to end the line and send the data to EDM VISION. Again, command sets can be placed on one line, as:

COPY CON COM1 < CR>

%YZI<CR>

^Z<CR>

which would zero reset the incremental measurement on the Z-axis. Or, several sets of commands can be sent:

COPY CON COM1 < CR>

%YXI^Z<CR>

COPY CON COM1 < CR>

1.375XI < CR >

^Z<CR>

Note that with the above sequence, the "%" sign precedes the first command, but not the second. The first command line is not ended with the "<CR>" before the "^Z" character. This leaves the communications channel in the command mode. The second command line does not require the "%" sign; if the second line were to include the "%", it would be interpreted as a [ CALC ] keypress. The second line is ended with a <CR> inside the "^Z"; any subsequent commands would require another "%" to start the line.

#### Sending data with communications software

The above examples show that DOS commands are cumbersome to use. Information is normally sent to EDM VISION from an external computer by using a communications program such as <a href="Mailto:CROSSTALK">CROSSTALK</a> (Microstuf, Inc.) or by writing a custom program in a higher-level language such as BASIC.

If using <u>CROSSTALK</u>, set up the communications parameters as required, then enter the command GO LOCAL. Type a "%", followed by any ASCII keyboard equivalent to EDM VISION keys. Each keypress is acted on directly, the same as if the key were pressed on

the EDM VISION keypad. Once a <CR> is given to stop the sequence, the "%" must be re-entered to start a new sequence.

year harmonical

Data can also be requested from EDM VISION, to monitor current operations or to compile data for process evaluation. Data requests are initiated by the computer by sending a control sequence; EDM VISION responds by sending the appropriate data and identifiers.

Data requests are preceded by a "?", followed by a control key. An example is "?U<CR>", which requests the current units setting. Table 5-3 gives a listing of all inquires that can be made, the control keys, and EDM VISION's response.

Table 5-3. Data inquiry commands

En I	No Information returned. Resets input and output buffers, and resets echo flag  (n = 0, 1, or 2) No information returned. For n = 0, no echo; n = 1, echo the character; n = 2, echo a descriptive string. Used for terminals requiring a keyboard echo  Prints screen. No menu boxes shown, no status/information window info. Same format as parallel printer printing
P	n = 0, no echo; n = 1, echo the character; n = 2, echo a descriptive string. Used for terminals requiring a keyboard echo  Prints screen. No menu boxes shown, no status/information window info. Same format as parallel
-40 kg	nformation window info. Same format as parallel
ln (	
1	(n = 1, 2, 3, 4) Reports incremental measurement for selected axis. For n = 1, X-axis; n = 2, Y-axis; n = 3, Z-axis; n = 4, W-axis. Response examples are: X = -1234.5678 lN Y = +1234.5678 deg frequest is for an undefined axis, response is:
	f an error exists on that axis, response is:  X = Error mm
	(n = 1, 2, 3, 4) Similar to incremental position eports
	When in EDM display mode, reports Z-axis max or min incremental measurement. Note that this is information that is not available for display. Same ormat as earlier examples. If not in EDM display mode, responds with:  * = *********************************
ZA S	Similar to incremental Z max or min reports.
	Reports current selection for linear measuring units, Report is "In" or "mm"
	Reports current selection for angular measuring units. Report is "D" if setting is decimal degrees, or "G" if setting is degrees-minutes-seconds.
	An I

in the armanises, plays set in various brought in a set --/1.

### Requesting data from EDM VISION



Table 5-3. Data inquiry commands (continued)

Command	Control ke	ey Response
Active axes	×	Report displayable axes. Report is "X Y Z W".  A "**" is reported if one or more cannot be
		displayed; as "X Y Z **"
Datum selection	Ţ	Reports current datum selection as "n", with n = 0 - 9. If current selection is Machine Zero, response is "Z"
Spark point table	S	Reports spark point table settings. Retract point denoted as "R". A typical report is:  Burn Direction: -
		1 = +nnnn.nnnn REF d
		2 = +nnnn.nnnn REF d
		3 = +nnnn.nnnn REF d
		4 = +nnnn.nnnn REF d
_		R = +nnnn.nnnn REF d
		where: n = a current setting, in the current units
		d = a datum number
Screen display type	М	Responds with a representation of the current ful screen display type:
and the same of		H = Help
	with the later of	D = DRO
		E = EDM
		T = Set point
		C = Calculator
		S = Set System
Filter/temp. statu	s F	Responds with code for filter presence and temperature acceptability:
		0 = Temperature is O.K.
		1 = Temperature too high
Port status	Q	Verifies the operation of the EDM VISION port
		connected to the computer. Response is:
		0 = no parity, data overrun, or buffer
		overflow errors have occurred since
LINGS		the last "Port status" check
		1 = one of the above errors has occurred since the last "Port status" check

Data inquires must be made by using a general-purpose communications program, or a custom higher-level language program; DOS commands do not support this type of two-way communication.

With the CROSSTALK program settings described, also set:

MOde = answer

DUplex = half

After setting the parameters, type at the "Command?" prompt:

GO LOCAL

Then type a "?" followed by any of the inquiry commands, and a carriage return. The screen displays the typed command, and the response. For example:



MOISIA.

Command: ?U<CR>

Response: IN

Command: ?l2<CR>

Response: Y = -1.4825 IN

The responses can be captured and saved to a file for processing.

The video monitor output allows a standard television monitor, or standard television equipped with a "monitor input" receptacle, to be used to display the same information as is shown on EDM VISION's CRT display. Monitors should be equipped with external horizontal width and vertical size controls.

Provide a suitable cable to connect the "EXT, VIDEO" receptacle on the back of EDM VISION to the monitor, and turn the monitor ON. No parameter settings are required.

The VISION Option Module video output is compatible with NTSC (National Television System Committee) composite input monochrome monitors. The connector is a standard phono connector.

The VISION Foot Switch assembly consists of a foot switch and integral 10' long cable with connector. The Foot Switch can only be used with a VISION Option Module. The connector is plugged into the appropriately marked receptacle on the VISION Option Module.

aparon yan penMili manader kali salesan mulab bawadap parasuper

Settings must be made within the parameter setting routine for the Foot Switch to work with EDM VISION. These settings are explained in <u>Section 3</u>. <u>SET SYS: EDM VISION setup operations</u>. Refer to that section for instructions on how to make the settings.

When installed and parameter settings have been made, the Foot Switch can act as a remote PRINT key. When the switch is activated, EDM VISION will send printing information about the current measurements to the currently-enabled port(s) (both parallel and serial ports may be enabled at the same time).

The ACU-RITE Parallel Printer is equipped with a cable and connector, and printing paper. The Parallel Printer can only be used with a VISION Option Module.

Assemble the paper holder and install the paper roll. Connect the cable to the parallel printer port of the VISION Option Module, and to the rear of the Parallel Printer. Connect the power cord. Turn the Printer ON and press the SEL (enable printing) key on the front.

ment bed gad ( DATA THE LINE) and the line had been as a series with

Using an external video monitor

### VISION Foot Switch

**Parallel Printer** 

CONTRACTOR OF STREET

Settings must be made within the parameter setting routine for the Parallel Printer to work with EDM VISION. These settings are explained in <u>Section 3</u>. <u>SET SYS: EDM VISION setup operations</u>. Refer to that section for instructions on how to make the settings. For the ACU-RITE Parallel Printer, the settings must be:

Parallel Status: ON to enable printing

Output Tail: zero to nine

LF after CR: NO

Printer Size: > = 40 (40 or more columns)

These are the settings in effect after performing a memory reset. After making the parameter settings, return to the DRO display mode. Press the [PRINT] key. Printing information is sent to the parallel printing port, and printed on the Parallel Printer. To advance the paper, press the DS (disable printing) key on the front of the Printer, then press the LF (line feed) key to advance the paper one line at a time.

Typical printed measuring information is shown in Figures 5-3 and 5-4 (the printed tapes are shown at reduced size). Note that not all of the information that is available on the measuring screens is printed. Of the information shown in the status and information windows, only the measuring units and datum number are reported. Menu key menus are also not shown. Current operations (such as-a partially-completed edge finding operation) are not printed.

estical temperatural for the recommendation and a register program of

DA	TUM 0			to the state of th
X	INC	+0.9688	IH	
	ABS	+0.9688	IH	
Y	INC	+8.7695	IH	a specific first Fact
	ABS	+0.7695	IN	Heriod Hit North
Z	INC	-8.4895	IN	both Basted idnoc
	ABS	-0.4095	IH	

VISION Foot

Switch

Using an external video

monitor

Figure	5-4.	DRO	display	mode	printing
		n Pai	rallel Pri	inter	

Paralle: Printe:

1	**********	*****	****	**********	******	***************************************
n Earling vouces in			UM 0	Maria Maria -		
pergalama PARLIS Richard	Late 190				IN	
			ABS	-0.4095	IN	
principality are per a Descriptional and a		MAX			IN	April 19
a we'l Noville that			ABS	-0.4095	IN	194593
sásted litroití tartsás		100	t., I.,	911 01		4.00
	1001-120-6	PT	ABS	+0.0000	IN	Chillian.
ļ	200000000	****	*****	**********	******	*******

Figure 5-5. EDM display mode printing on Parallel Printer

In addition to printing measuring information, screen information can be printed. All informational screens, parameter setting screens, and full-screen functions that replace the DRO/EDM measuring displays can be printed. For example, if the [SET POINT] key had been pressed, replacing the DRO display; then the [PRINT] key were pressed, the following would be printed:

SET POINT

Seark Points for
EDM operation,
Machine Zero
Positionins, and
Edse Finder Offsets
are maintained in
this section.

THE DRIVEN

A MOTERY MOST INTER-

Select the operation desired by pressing the appropriate menu key.

Figure 5-6. Typical screen printing on Parallel Printer

Again, the menu key information and the boxes around the menu are not printed. For screens that consist of a title and menus (such as some HELP and SET SYS screens), only the title would be printed.

The ACU-RITE Storage device is a Toshiba T-1000 laptop computer. It can be used as an RS232-C communications device for bi-directional communications with EDM VISION through an installed Option Module. This allows the computer to draw information from EDM VISION, and to pass information to EDM VISION. A VISION Option Module must be installed to allow the use of the Storage device.

The Storage device comes complete with a cable to attach the device to one of the parallel ports on the VISION Option Module. Plug one end of the cable into the connector on the rear of the Storage device and the other end into one of the RS232-C ports on the rear of the VISION Option Module (Port 1 is suggested; default settings for this port are compatible with the Storage device).

The Storage device also comes with a battery charger/AC adapter. Plug the connector from the adapter into the receptacle on the Storage device, and the other end into a standard 115 VAC wall socket.

Storage device (external computer)

Manuals and other programs on diskettes are furnished with the Storage device. One of these is an ACU-RITE Remote Storage diskette. The Remote Storage diskette is not used with EDM VISION.

Settings must be made within EDM VISION's parameter setting routine for the Storage device to work with EDM VISION. These settings are explained in <u>Section 3</u>. <u>SET SYS: EDM VISION setup operations</u>. Refer to that section for instructions on how to make the settings. For the ACU-RITE Storage device, the settings should be:

#### RS232-C Functions:

Port Function:

Comp (computer)

Output Tail:

0 to 9

LF after CR:

NO

Printer Size:

> = 40 (40 characters or more width)

SEE LINES

bra venimou izon

den Hour bireta

controlly messing

#### RS232-C Protocols:

Baud Rate:

1200

Parity:

None

Data Bits:

Egum Ed. Typicy Income Im

Stop Bits:

Total figure Printing T

XON-XOFF:

YES

CTS:

Inactive

These settings are the default values for Port 1 (except that the Port Function is set to OFF), and will be restored whenever an EDM VISION memory reset is completed. The Storage device must be set to compatible settings; factory default values were set so that the above EDM VISION settings are correct. If settings with the Storage device are changed, EDM VISION settings must also be changed so that both devices remain compatible.

The Storage device provides all communications types and features described for the VISION Option Module. Refer to the description of that accessory in this section for further information on using the Storage device.

and to year without about Disability to use common widout of hyp

Storage device

ismetxe)

(reinamics)

### Section 6. Appendices

#### CAUTION

Do not remove the chassis cover from EDM VISION - there is nothing within the chassis that can be serviced in the field.

REFLIE POSTHOL AND ARRIVE MESSAGE NO. of that Departs 3 is

### Appendix A. Troubleshooting

EDM VISION is equipped with an electrically-powered intake fan to dissipate internally-generated heat, and features a passive, filtered, fresh-air intake. Adequate airflow to the intake should be allowed for, as well as accessibility to clean or replace the filter assembly.

If EDM VISION's Internal temperature rises above a preset limit, a "CHECK FILTER - PRESS HELP for more info" message will appear on the screen when in the DRO or EDM display mode. After pressing the [HELP] key, the HELP screen offers assistance in isolating the problem.

Ventilation system

#### CAUTION

Whatever the reason for the "CHECK FILTER" message, it is imperative the unit be shut down and the fault rectified as soon as possible. However, the immediate machining operation may be completed.

The following are the most common reasons for an over-temperature condition, and the response required to overcome the problem:

larities and howing form larges at supply for the MOST and strike larities and

- Inadequate airflow the air intake or exit is blocked or restricted. Make sure paper, wipes, or debris is not restricting air circulation around EDM VISION. This is especially important behind the unit, where the air intake and filter are located; and underneath the unit, where the outlet is located.
  - Dirty filter air flow through the filter is too restricted to cool the unit properly. The filter must be cleaned or replaced. The filter holder is easily removed by releasing the latches around the periphery. Remove the foam filter from the holder and either clean the filter by washing, or replace the filter. If cleaning the filter by washing, make sure the filter is dry before it is re-installed. Replacement filters are available from your distributor or OEM, or from the ACU-RITE Service. Center at (800) 632-3222.

"CHECK FILTER" faults and remedies

EDM VISION

Engine recolded

Ambient temperature is too high - the ambient temperature in the work area is outside the limits within which EDM VISION can operate. Operations must be suspended until the ambient temperature is reduced.

EDM VISION is designed to function to a maximum ambient temperature of 40° C (104° F). If the temperature in the work area is above 40° C, EDM VISION should be shut down until temperatures return to within the normal operating range.

Exhaust fan is not working while the "CHECK FILTER" message is displayed - operation of the fan must be restored. The fan only works at higher temperatures; however, if the "CHECK FILTER" message is shown, the internal temperature is elevated, and the fan should be working. The fan has failed, or an internal failure has stopped power to the fan.

Ventillation system

CHECK FILTER froits shot

selbemé:

Appendix A.

Proubleshooting

#### CAUTION

Do not operate EDM VISION if the exhaust fan is not working, and the "CHECK FILTER" message is displayed. Excessive internal temperatures can damage the electronic components.

Contact your ACU-RITE distributor or OEM, or call the ACU-RITE Service Center at (800) 632-3222 for repair or replacement information.

can populate. He countries that minimize machining doeselfor may

### **Fuses**

If there is power at the cord leading to the electrical input module on the back of the unit, but EDM VISION but it does not power up, check the fuse on the back of the chassis. The fuse is located within the power entry module.

Remove the power cord. Use a thin straight-blade screwdriver to remove the cover; remove and check the fuse. If the fuse is bad, replace it with an equivalent 1.5A 250V, 20 mm long fuse. Replace the fuse cover by snapping it back into place, and reconnect the power cord.

### Error reports

EDM VISION includes built-in test and error-checking circuitry. This circuitry identifies hardware and software errors that occur, and reports the problem to the operator.

Errors may involve hardware, where internal circuits have falled to function properly; or software, where information is not being processed properly. Errors are reported to the operator with messages on the display, such as "ERR C2". Figure 6-1 illustrates a C2 error report.

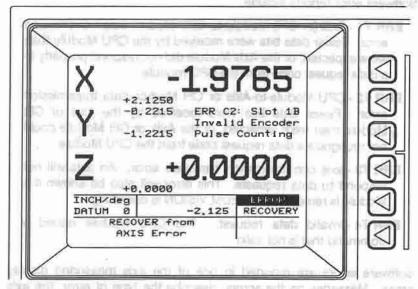


Figure 6-1. Encoder counting error C2

The error report is shown in the axis position relating to the axis module that had the problem, or was involved with the last communication that did not work properly. The report includes the error type and the slot location of the affected module.

Until the error is corrected, the measurement for that axis will remain the same; although further counting pulses are recorded internally. In addition, functions that affect the measurements (presetting, zero resetting, etc.) are inoperative; pressing those keys produces an "INCORRECT KEYPRESS" message. Pressing the HELP key gives further information about the error reported, and methods for recovery from the error.

Two types of errors are reported. Software errors are identified as "T" errors; hardware errors are identified as "C" errors.

Uterruse. Perefroide elecular constantly discilled the laboraty of

Software errors occur when data is passed from one module within EDM VISION to another module. This type of error is a common occurrence with modular electronic equipment. Although the problem is detected as a failure to pass data, most software errors that are reported are a result of hardware problems.

Software errors are self-correcting to some extent. When a software error occurs, EDM VISION attempts to re-pass the missed data several times before the error is reported. Most errors are corrected and never reported. In this way, the operator is not burdened with "nuisance" errors; only uncorrectable errors are reported.

proceediums through the restaurance about the error and recovery proceediums through the restaurance accounts any to metant the Asia of CFI Module. If the recovery proceedings subposeds, if he reported on another account, press the < PESSIBLE > more large to return to

Software errors

Hardware errors

**EDM VISION** 

Error recovery

Software error reports include:

- ERR T1 Axis (or CFI) Module-to-CPU Module data transmission error. Fewer data bits were received by the CPU Module than were expected, or the Axis Module did not respond properly to a data request code from the CPU module.
- ERR T2 CPU Module-to-Axis or CFI Module data transmission error. Fewer data bits were received by the Axis or CFI Module than were expected, or the Axis or CFI Module could not recognize a data request code from the CPU Module.
- ERR T3 axis communication hardware error. An axis will not respond to data requests. This error will also be shown if a Module is removed while EDM VISION is operating.
- ERR T4 invalid data request. The CPU Module issued a command that is not valid.

Software errors are reported in one of the axis measuring display areas. Messages on the screen describe the type of error, the axis involved, and provide a method for recovery from the error. Pressing the [ HELP ] key shows further information about the error, and offers suggestions for error recovery.

#### Hardware errors

All hardware errors are flagged as soon as they occur. Since hardware errors relate to counting signal integrity, there is no attempt to correct them as is done with software errors; attempts at correction could result in erroneous measurements. Hardware error reports include:

- ERR C1 axis counting circuit error. The Axis or CFI Module is unable to access the encoder pulse counting circuitry or the circuitry fails to count correctly. This error may be corrected by resetting the axis board in question. However, it should be interpreted as a serious error; the Axis or CFI Module should be serviced or replaced.
  - ERR C2 encoder input circuitry error within an AXIS or CFI Module. Electronic circuits constantly monitor the integrity of the encoder signal for slew speeds greater than the unit can accommodate, for incorrect pulse train sequences, and for electromagnetic interference (noise) that will make the unit count incorrectly. C2 errors are reported if any of these conditions occur. These are problems external to EDM VISION. The operator must first correct the external problem, then reset the axis board.

#### Error recovery

When an error occurs, the error message is shown on the measuring display for the axis affected. In addition, the primary menu key changes to an "ERROR RECOVERY" selection. Pressing this menu key displays further information about the error and recovery procedure. Press the < FIX AXIS > menu key to re-start the Axis or CFI Module. If the recovery procedure is successful, it is reported on another screen; press the < RESUME > menu key to return to normal operation.

Using the error recovery procedure will recover from most errors. If the error was caused by an internal hardware problem, however, the error will not be cleared, or will be flagged again. If that happens, EDM VISION will require service.

#### IMPORTANT

If a Home Reference Point was set on the axis, the Reference Point will have to be reset after recovering from the "C"-type error.

Other errors can occur that cannot be recovered from. They involve a serious hardware failure that cannot be fixed by internal routines. These are stated in a full-screen display, and advise the operator to contact the distributor or OEM, or the ACU-RITE Service Center.

Other errors

If service is required, it is helpful to service technicians to identify the type of equipment installed in EDM VISION, its specific configuration as defined by the revision date, as well as the specific version of software installed in the CPU Module as defined by the revision date of the ROM chips installed.

Hardware identification

Press the [SET SYS] key, then the < MISCELLANEOUS >, < TESTS >, and < HARDWARE IDENTIFICATION > menu keys.

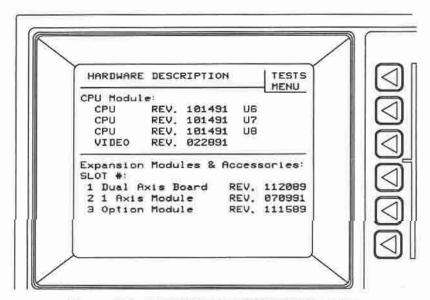


Figure 6-2. HARDWARE DESCRIPTION screen

The <u>HARDWARE DESCRIPTION</u> screen indicates the individual VISION Modules installed in EDM VISION; and the revision date for several ROM chips on the CPU Module and for other installed Modules. Figure 6-2 shows that an Option Module accessory has been installed. The revision dates for your EDM VISION will likely be different from those shown.

Table 6-1. EDM VISION specifications

Appendix B.
<b>EDM VISION</b>
specifications

Characteristic	Specification
Operating conditions	0 to 40°C (32 to 104°F) 25 to 85% relative humidity (non-condensing)
Storage conditions	-40 to 60°C (-40 to 140°F) 25 to 95% relative humidity (non-condensing)
Input voltage requirements	95 to 264 VAC, single phase
Input frequency	50 to 60 Hz
Input current	1 A maximum
Electronics	Multiple microprocessors, RAM and ROM memory, custom VLSI circuits
Display	7" diagonal CRT
Display resolutions	Operator configurable: 0.00001 to 1mm 0.0000005 to 0.05"
Encoder resolutions	Linear: selectable, 0.01 to 1000um (microns), or any resolution that can be expressed as multiples of 0.0000001um to a maximum of 99,999,999um. Resolution must be in um
	Angular: selectable, 360 to 36,000,000 counts per revolution, or any resolution that can be expressed as multiples of 1 count per rev. to a maximum of 99,999,999 counts per rev.
Number of axes	Display: 1, 2, 3, or 4 (user configurable).  Maximum installable: 9
Encoder input characteristics (linear or rotary)	Channel A & B TTL square wave signal in quadrature (900 nominal phase relationship) and TTL square wave Fiducial Trigger Output signal (when provided)
Size	14" W x 14.5" D x 7.5" H
Weight	Approximately 25 lbs
Mounting	From bottom, four #8-32 threaded inserts
Recognition/ approval	UL, CSA pending
FCC compliance	Class A

Table 6-2. Encoder mechanical requirements

Characteristic	Requirement	nt
Resolution	Linear (microns)	Angular (counts per revolution)
Support Hard	1000	360
The resolutions listed are for	500	720
selections that can be made	200	1800
within EDM VISION. Any	100	3600
resolution encoder may be used,	50	7200
that provides a resolution that can be stated as an even	20	18000
multiple of 0.0000001 um (for	10	36000
linear encoders) or 1 count per	5	72000
revolution (for angular	2	180000
encoders). Example: an	1	360000
encoder has a resolution of 0.0005"; this is equivalent to	0.5	720000
(0,0005" x 25.4mm/inch x	0.2	1800000
1000um/mm) = 12.7um.	0.1	3600000
The second secon	0.05	7200000
	0.02	18000000
	0.01	36000000
Connector	Bendix PTO 6A- (or Cannon, Burndy e	THE RESERVE OF THE PARTY OF THE

### Appendix C. Encoder requirements

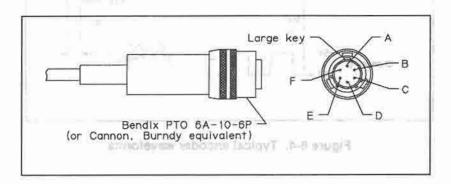


Figure 6-3. Required encoder connector

Table 6-3. EDM VISION receptacle pin-out

Pin	Signal
A	Channel A square wave counting signal
В	Channel B square wave counting signal in quadrature (90° nominal phase relationship) with channel A signal
C	Vcc, +5.1 +/-0.1 VDC @ 140 mA (supplied by EDM VISION)
D	Common (power supply and signal return)
E F	Shleid, reading head casting ground
F	Fiducial Trigger Output (FTO) signal

If installing a non- ACU-RITE encoder, a connector kit may be obtained to adapt the encoder cable for use with EDM VISION. Contact your ACU-RITE distributor or OEM, or the ACU-RITE Service Center at (800) 632-3222, and order part number 382214-000.

EDM VISION

X Tarresti



Table 6-4. Encoder electrical requirements

Characteristic	Requirement			
Output signals Incremental	Two square-wave signals, channels A and B, in quadrature (90° nominal phase relationship)  One square-wave signal			
Signal levels	Low: 0 to 0.8 VDC High: 3.5 to 5.1 VDC			
Maximum current draw	140 mA			
Maximum slew speed (counting signal rate)	200 KHz			

20 351

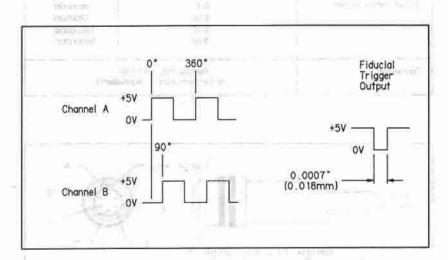


Figure 6-4. Typical encoder waveforms

Tryuth 6-1: Required encoder numerical



A connector is supplied with EDM VISION for attachment to the Z-axis output receptacle. The connector provides easy installation by simply inserting wires into the connector block and tightening the appropriate screw. If required, a replacement connector assembly may be obtained from your ACU-RITE distributor or OEM, or from the ACU-RITE Service Center; order part number 387830-804.

Seven sets of two-wire outputs are provided as detailed in <u>Section 1</u>. <u>Installation</u>. Each set of two connections leads to a normally-open relay contact within the Z-axis CFI Module. Conditions for contact closure are detailed in Section 1. Refer to Table 6-5 for connection information for the Z-axis connector. Specifications for the contacts are given in Table 6-6.

One additional set of two connector positions is used for the ACU-RITE First-Spark Detector accessory. This set of connections provides a supply voltage to the accessory, and First-Spark detection signals to EDM VISION.

# Appendix D. Z-axis connector and output specifications

#### CAUTION

Connections to the Z-axis connector must not exceed the limitations shown in Table 6-6. Connections for the First-Spark Detector accessory must be as noted in the Reference Manual for the accessory and in Table 6-5. Exceeding specified limits or making improper connections can result in damage to EDM VISION, the First-Spark Detector accessory, or external equipment.

Bill SPI Justile Education as recovering the disease material and recovering register.

Machinett Within June Bast don't prince commenced persons still play because it's within prince of the partial June within the property of the partial of the property of the property of the partial of the property of the property of the partial of the property of the partial of the property of the partial of the partial

mand and helpful feeting of the conditional of the latest between the places.

Table 6-5. Pin-outs for the Z-axis CFI connector

Connector position	Build would infer Function with a more parties
1 2	Black wire (from ACU-RITE First-Spark White wire Detector accessory)
magazia malay	EDM Outputs Enable
81-1-5 pm	Spark point 1
7 8 4 8	Spark point 2
9	Spark point 3
11 12	Spark point 4
13 14	Retract point
15 16	Fault

Table 6-6. Z-axis module relay contact specifications

with the strong strong of the same strong of the Relative was the Relative will be same to the Relative

60 W, 125 VA
220 VDC, 250 VAC
2 A (DC or AC)
3 A (DC or AC)
0.6 A @ 125 VAC
0.6 A @ 110 VAC

When all wires have been installed, insert the connector block into the housing shell half that contains the strain relief grip. Insert the block with the screws towards the housing shell half and center the block vertically within the shell; bosses on the housing mate with recesses at the screw locations. Install the strain relief strap with the two screws, and snap the opposing connector shell half in place. A clear plastic label cover is also provided; insert a paper label on the upper-rear corner of the connector and snap the label cover in place.



Appendix D.

turptuo bris

Z-axis competion

specifications

Insert the connector into the receptacle on the back of the Z-axis CFI Module. Keys on the connector and receptacle prevent incorrect installation.

#### CAUTION

Seating the connector will require a firm push; make certain that EDM VISION is securely mounted or well-supported while inserting the connector.

The VISION Option Module has connectors on its rear panel to connect with printers, computers, edge finder probes, etc. Figure 6-5 illustrates the location and general appearance of each connector.

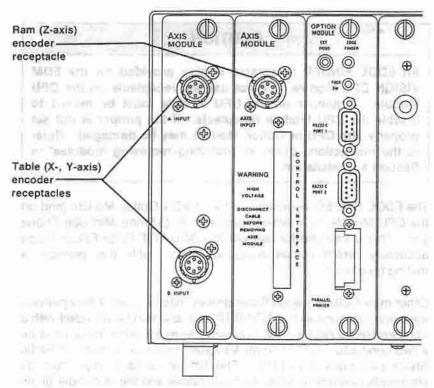


Figure 6-5. VISION Option Module connector locations

In addition to making the physical connections to the receptacles, several ACU-RITE Accessories or other external equipment require that parameter settings be made to allow communication between the devices, or to set the function for the accessory. Refer to <a href="Section3.SET SYS: EDM VISION setup operations">SET SYS: EDM VISION setup operations</a> for instructions on how to make the settings.

The external video receptacle is provided to drive an external monitor. A cable assembly must be fabricated to connect the VISION Option Module to the monitor. The mating connector must be a standard audio connector, such as Radio Shack part number 274-339. The cable must provide an appropriate connector on the opposite end that is suitable for connecting to the monitor.

MARKET THE SHOULD TAKE OVER JOSEPH STREET, AND THE STREET SHOULD SHOULD

Appendix E. A Rodal
VISION Option
Module
connectors

**EXT. VIDEO** 

### EDGE FINDER

Rolled Molely

Module

SCIV THE

connectors

The EDGE FINDER receptacle is provided for use with the ACU-RITE Edge Finder Probe accessory. Other edge finder probes or EDM electrodes can be installed to perform the same function.

#### CAUTION

An EDGE FINDER receptacle is also provided on the EDM VISION CPU Module. Do not use the receptacle on the CPU Module. A jumper on the CPU Module must be moved to disable the CPU Module receptacle. If the jumper is not set properly, the CPU or Option Module may be damaged. Refer to the instructions given in "Installing/removing modules" in Section 1. Installation.

The EDGE FINDER receptacle on the VISION Option Module (and on the CPU Module) is a two-conductor, 1/8" (3.5mm) Mini-size Phone jack. This is intended for use with the ACU-RITE Edge Finder Probe accessory, which comes equipped with a cable that provides a mating connector.

Other manufacturer's edge finder probes may be used, if they perform the same functions as the ACU-RITE unit, and can be provided with a comparable connector. The connector from the edge finder must be a two-conductor, 1/8" (3.5mm) Mini-size Phone plug, such as Radio Shack part number 274-288. The ball or contact edge must be electrically isolated from the electrode holder and the remainder of the EDM machine. The conductor from the edge finder must be wired to the central contact on the plug, and the other conductor from the workpiece or EDM machine wired to the side contact on the plug.

#### FOOT SWITCH

The FOOT SWITCH receptacle is provided for use with the ACU-RITE Foot Switch Assembly accessory. Other switch arrangements may be provided to perform the same function.

The receptacle on the VISION Option Module is a two-conductor, 1/8" (3.5mm) Mini-size Phone jack. This is intended for use with the ACU-RITE VISION Foot Switch Assembly accessory. The Foot Switch accessory is provided with a cable and mating connector that plug directly into the VISION Option Module.

If using a switch other than the ACU-RITE assembly, the connector from the switch must be a two-conductor, 1/8" (3.5mm) Mini-size Phone plug, such as Radio Shack part number 274-288. The external switch must be a normally-open, momentary-closed, SPST switch. One side of the switch must be wired to the central contact on the plug, and the other side wired to the side contact on the plug.

### RS232-C PORT 1

The RS232-C PORT 1 receptacle on the VISION Option Module is provided for one- or two-way communication between EDM VISION and external computers, printers, and other devices that receive and/or send information via the RS232-C protocol. The receptacle is

intended for directly connecting the ACU-RITE Storage device (a laptop computer) to EDM VISION by using the cable provided.

Other types of equipment can also be installed. Although RS232-C is a standard for describing the connections and communications between intelligent equipment, there is a wide variation in how the standard is implemented. In effect, there are several ways to accomplish the same thing, and various equipment manufacturers have elected to provide the features in different ways. To the user, this means that he must examine the hardware and software requirements for the equipment on both ends of the communication loop, and do whatever is necessary to make the equipment work together.

EDM VISION provides the hardware and software features required to work with any RS232-C device. The cable wiring and internal settings can be altered to provide the required compatibility.

Delete To Fred Equipment and Administration 188

and depot i worth. It's a literal property

The receptacle provided on the VISION Option Module is a 9-pin subminiature D-connector (male). The mating connector must be a 9-pin subminiature D-connector plug (female), such as Radio Shack part number 276-1538.

The connector required for the external equipment will vary: some require male configurations, and some female; some require receptacles, and some plugs. Most external equipment provides either a 9- or 25-pin subminiature D-connector. Refer to the reference manual for the external equipment to determine the type of connector required.

RS232-C communications between equipment can involve both hardware and software "handshaking", means for informing each other of their current communications abilities. The status of the interconnections and the signals sent between the "terminals", or pieces of equipment, indicates whether communications can proceed. The DTR/DSR and RTS/CTS signal lines and the XON-XOFF setting are handshaking signals. At least some of these signals must be provided on all RS232-C equipment, to let one piece of equipment know the status of the other. This is important because both pieces of equipment can't send data at the same time; one must "listen" while the other "talks". The handshaking arrangement makes one terminal wait until the other terminal is ready before transmitting data.

For example, each terminal can be an independent computer working on its own program, until it needs data from the other computer. The first computer's program will set up this terminal's communication port to indicate it is ready to receive data. The second computer will continue with its program until the data it has prepared is ready, then "ask" the first computer if it is ready to receive the data by examining the interconnection lines. Since the first computer has already set up its port, the data is passed, and both computers can continue with their programs independently once again. Note that the first

Abote Williams of Blots, No. 20. Separated and Level Microsoft about a level of the

Mating connector

interconnections and

ED NOTES

Inter-equipment communications requirements

computer would clear its port at the end of the data-passing session, to show that it was "busy" and no longer capable of receiving data.

Even with a setup where only one of the pieces of equipment can transmit information (such as a computer / printer combination), the computer can only send information until the printer buffer is full; then must wait until the printer again has room for the next block of data. The printer must keep the computer informed of its status via handshaking to avoid problems.

RS232-C hardware handshaking signals take the form of applying and removing voltages (+/-12 VDC) to specific interconnected lines. Each terminal must determine the status of these lines and, if provided, of software settings before it is allowed to transmit information.

# Interconnections and settings

Refer to Table 6-7. The RXD signal line is a data-receiving line. The TXD line is a data-sending line. Note that the table shows these two signals are crossed; the TXD line on one terminal connects to the RXD line on the other terminal. All RS232-C equipment is provided with these two signal lines, although different acronyms are sometimes used. In fact, for some "receive only" equipment like printers, the manufacturer has identified the TXD line for their equipment as the line that the equipment expects to be transmitting.

The DTR (Data Terminal Ready) and DSR (Data Set Ready) signals form one handshaking signal set. This signal set is not always provided; for equipment such as printers that can only receive data, these signals are not required. However, since the computer attached to the printer still needs a signal on its port, a common arrangement is to wire the corresponding pins together within the cable attached to the computer port. The signal thus provided makes the computer think that the data terminal, the printer, is ready every time the computer has a data set ready to send.

The RTS (Request To Send) and CTS (Clear To Send) signals form another handshaking signal set. Again, some equipment does not provide for one or both of these signals.

As an example, at least one commercially-available, simple printer provides a four-pin connector, with only two active signal lines and a ground. The manufacturer did not identify the signals by the most-commonly accepted acronyms. One was described as a data line, and the other as a "busy" signal. Looking at the requirements for the device and these descriptions, the installer must realize that the data line must be connected to the TXD terminal on EDM VISION; the "busy" signal connected to the CTS terminal; the ground lines interconnected; and the DTR/DSR lines at the EDM VISION port wired together.

Software handshaking is provided by an XON-XOFF feature within EDM VISION. To use software handshaking, both terminals must have this capability. When provided, one terminal can send a special character to the other on the data transmission line, to make it temporarily cease transmission. A second special character is sent to

restore the transmission. To enable the use of the feature, both terminals must have their appropriate lines set, through their individual programs or features, to allow both devices to transmit simultaneously. EDM VISION'S XON-XOFF feature can be selected if needed, with a parameter setting for Option Module RS232-C protocols; refer to Section 3. SET SYS: EDM VISION setup operations.

#### IMPORTANT

the Primited Printer to provioud with a cause to directly

HANNY Johnnier Brieflich ist itter war to desirier is within

The most common inter-equipment connections required are shown in Table 6-7 for both 9-pin and 25-pin subminiature D-connectors. This table reflects the requirements for a majority of personal computers and other related equipment.

The installer must consult the reference manual supplied with the external equipment to determine its signal requirements and thus how to construct the interconnecting cable. Installing an improperly-constructed cable can result in damage to EDM VISION or to the external equipment.

Table 6-7. RS232-C PORT 1 pinouts

VISION Option Module		a warming or a	External equipme	nt
Pin#	Signal	Pin # (9-pin D-sub)	Pin # (25-pin D-sub)	Signal
1	Not connected	1	1	Not connected
2	RXD	3	2	TXD
3	TXD	2	3	RXD
4	DTR	6	6	DSR
5	Ground	5	7	Ground
6	DSR	4	20	DTR
7	RTS	8	5	CTS
8	CTS	7	4	RTS
9	Not connected	9	8-19, 21-25	Not connected

Some external equipment does not require all of the connections shown. A common arrangement, especially for single-directional communications devices that only receive data (such as a printer) is for no connection to the external equipment for DSR and DTR signals.

#### IMPORTANT

If the external equipment does not require the DTR and DSR signal connections, a modification to the wiring shown for the EDM VISION RS232-C port must be made: pins 4 and 6 must be wired together.

#### Cabling

RS222-C PORT 2

#### RS232-C PORT 2

The RS232-C PORT 2 receptacle on the VISION Option Module is exactly the same as PORT 1. The ports may be used interchangably. The connector and wiring required are the same as shown for PORT 1.

District with a particular author for Cotion Module RESIZE or Cotion Module Resident authors of the Section 2 Set 578 STREET SYS STREET

#### PARALLEL PRINTER

Cabiling

The PARALLEL PRINTER receptacle provided on the VISION Option Module is intended for use with the ACU-RITE Parallel Printer accessory. The Parallel Printer is provided with a cable to directly connect between the VISION Option Module and the Printer.

Most parallel printers equipped with a Centronics-style connector can be driven by the Option Module. In most cases, the ACU-RITE Parallel Printer Cable accessory (which may be purchased separately) can directly connect the VISION Option Module to the printer. The cable is provided with an AMP Inc. SDL-style connector (shielded data link - AMP part number 1-520424-6) on one end for connection to the VISION Option Module, and a standard Centronics-style connector on the other end for connection to a parallel printer.

Table 6-8 gives the pin-outs for the Option Module PARALLEL PRINTER receptacle. Pins 1 to 9 and 14 are data signals from the Option Module to the printer. Pins 10 to 13 are status signals from the printer to the Option Module.

Table 6-8. Pin-outs for the PARALLEL PRINTER receptacle

Table 5 7 TS TS-C PORT 1 should

Pin number	Signal	
1	Strobe (active low)	
2	Data line #1	
3	Data line #2	
4	Data line #3	
5	Data line #4	
6	Date line #F	
7	Data line #6	
8	Data line #7	
9	Data line #8	
10	Acknowledge (active low)	
11	Busy	
12	Paper empty	
13	Select	
14	Auto feed	
45	N/C	
16	Ground	

Matagan 1925 Salarah Affair a Throtology Material and Champaga (Salaran property)

All internal parameters that are set by using the [SET SYS] key have been set to default values at the factory. In addition, Spark Point Table settings that are made by using the [SET POINT] key and < Edit Spark Point Table > menu key have been given default values. These settings are restored whenever the memory resetting routine is used. This can be helpful for familiarizing the operator with EDM VISION operations; many of the examples shown in Section 4. EDM operations start with default settings. It can also be useful for troubleshooting, since the system will be in a known configuration.

Appendix F.
Parameter
default settings

To reset all internal parameters and default Spark Point Table settings:

- 1. Press the [ SET SYS ] key.
- 2. Press the < MISCELLANEOUS > menu key.
- 3. Press the < RESET ALL MEMORY > menu key.
- 4. Enter the password.
- Press the < YES > menu key.
- Press the < YES > menu key.

Table 6-9 lists the defaults for all internal parameters. It reflects EDM VISION with only the factory-installed VISION Modules: a 2-Axis Module and a single-axis CFI Module. Adding or exchanging Modules may affect default values.

Tart asonich

Table 6-9. EDM VISION default parameter settings

SET AXIS (requires password) LABEL AXES Slot 1A: X Slot 1B: Y Slot 2A: Z SET PARAMETERS X-, Y-axis: Motion type: Linear Res. (microns): 10. FTOs available: YES Count Direct.: Positive Motion type: Res. (microns): 10. FTOs available: YES Count Direct .: Positive Pulsed Output: NO ERROR COMPENSATION All axes: single interval, 0 PPM DOM: MARKETON SET REF. POINT All axes: no Home Reference Points are set SET DRO AND EDM DISPLAYS DRO DISPLAY FORMAT X, Y, Z Display axes: Display Resolution: 0.01 mm, all axes Approaching Zero Warning: 0. mm, all axes EDM DISPLAY FORMAT Display Resolution, for all three Z-axis measurements: 0.01 mm Bar Graph: Off **ABS ONLY** Display:

Table 6-9. EDM VISION default parameter settings (continued)

PARALLEL PORT FU		THE RESERVE OF THE PARTY OF	
Parallel Status:	On	MARKET THE PARTY	
Output Tail: LF after CR:	3 NO		
	>=40		Ŋ.
RS-232 FUNCTIONS		and the principle	
Port 1			
Port Function	: Off		
Output Tail:	0		
LF after CR:	NO		
Printer Size:	>-40		
Port 2		The Albert Control	
Port Function	: Off	December 1	
Output Tail:	4		
LF after CR:	NO		
Printer Size:	< 40		
RS-232 PROTOCOLS			
Port 1	Carl Comment		
Baud Rate:	1200		
Parity:	None		
Data Bits:	7	ALTERNATION IN	
Stop Bits:	1		
XON-XOFF: CTS:	YES Inactive		
013.	macuve		
Port 2			
Baud Rate:	600		
Parity:	None		
Data Bits:	8		
Stop Bits:	2		
XON-XOFF: CTS:	NO Inactive		
UIS.	macuve		

Table 6-10 lists the Spark Point Table default values.

Table 6-10. Spark Point Table default settings

	Burn Direction: +	
Point	Position (INCH)	REF
1	0.	0
2	0.	0
3	0.	0
4	0.	0
Retract (5)	12	0

Parameter

refoult settings

Although the concept of applying error correction factors, either single- or multiple-interval, is straightforward, several factors complicate the application of these techniques. The error measured on a machine tool is a result of inaccuracies in the machine tool geometry, normal clearances provided for table movement, and setup variations.

Appendix G.
Advanced error
compensation
techniques

Measuring errors are inherent in all machine tools. Errors are a result of inaccuracies in the machine tool elements such as leadscrews, screw followers, excess play in the gibs, etc. Perceived errors can result from measurement variations. Errors are also produced by inaccurate geometry (ways that are not straight) and by the moving mass of the machine tool tables. One example of this type of error is the result of a longer table that overhangs the base at the extreme limits of travel. With the table all the way to one side, gravity pulls the table down, which causes errors. When the table has traveled halfway and is centered on the table, the effects of gravity cancel. When the table has traveled all the way to the other side, gravity acts on the opposite side of the overhanging table, increasing the amount of measured error.

Additional sources of error

teicher laufaufan

This situation can be further affected by a setup that is off-centered. Extra weight will overhang farther in one table direction than the other. For the same reason, different setups that involve significantly different weights on the table (due to either the workpiece or the fixturing) affect the error for each setup.

Errors are also affected by the height of the setup above the table. Work close to the table is generally less affected by geometry errors than work significantly above the table surface. The setup location front-to-back on the table can also have an effect on the measured error.

Some errors are not repeatable; performing the same error measurement along a table several times will show some "scatter", or minor variations in the error found at any one point. Unless the machine tool tables are extremely loose, this type of error tends to be minor. To check for this type of error, perform the same measurements along the table several times, and plot all data points. The measurements at each point should all be grouped tightly; excessive variation at any point can indicate problems. In any case, there is no way to compensate for non-repeatable errors. In order to apply an accurate error compensation, this type of error must be minimized. For the best results, the machine tool should undergo maintenance to clean and tighten the ways, and all moving parts should be examined for wear.

The remaining errors tend to be repeatable, at least with similar setups. In general, the operator should perform an error analysis in the area used most often for EDM operations, and at the height used most often.

### Complications require advanced error compensation techniques

Setup-dependant complications can require that the operator use more advanced error compensation techniques to maintain the greatest accuracy. For example: when operations often use different areas of the machine table for different setups, the operator may need to set the error compensation for each setup, rather than making a single setting. In addition, improvements in the technique used to set either single- and multiple-interval error compensation can give better results.

## Advanced single-interval techniques

Additional sources of

Even though the operator applies the best techniques for setting error compensation, other complications can arise from an incomplete analysis of table errors or an incomplete understanding of how EDM VISION performs automatic error compensation and applies error correction factors.

and writing afficiently the complete and any law in the product that they have

disease a mental and a laboral section, and the presentation of th

#### Select the compensation area for the setup

Figure 6-6 shows single-interval error compensations determined by picking two points from the error data that is available for analysis, and drawing a straight line between them. EDM VISION's automatic single-interval error compensation is established in much the same manner; two points are selected, and EDM VISION finds the straight line between them.

continued with a second with a larger of the larger of the

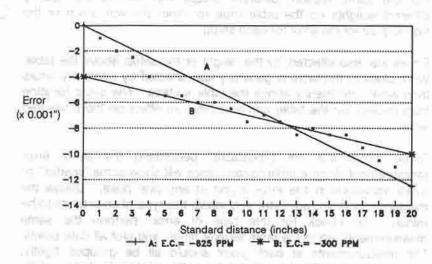


Figure 6-6. Error corrections defined by selecting two points from the error data

The upper line in the graph, marked line "A", was established with just the end points (X = 0 and 20) from the set of error data. This line is a fair approximation of the error data. Line "B" was also established with two points from the error data, at X = 5 and 15. This is a poorer approximation to the error data at either end, but is better than line "A" in the center.

Figure 6-7 shows the residual errors with these two settings for single-interval error compensation. Residual errors are the errors remaining after applying the error compensation; these errors are what would be measured if performing the error measurements again, with the error compensation active.

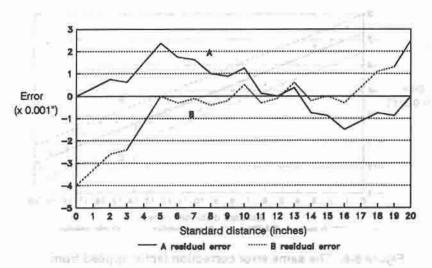


Figure 6-7. Residual errors with single-interval error corrections shown in Figure 6-6

Even though line "B" is a poorer approximation to the data overall, it is a better "fit" near the center of travel and produces much less residual error in this area. If most EDM operations are performed in the range of movements represented by X = 5 to 15, error correction "B" may be a better selection.

man in thing with chapter and region with all them

THE PARTY OF THE PROPERTY AND THE RESERVE WITH THE PARTY OF THE PARTY

TO IN THE ENTER STORY - MACH TONOURING MISTELL STORES AND VALUE.

SCHOOL FIRST, ATTRICE TO EXCESS MANY PROTECTION OF BOOK MIT IS EXCESSED.

**EDM VISION** 

James Home Recommon Points

"A" per condition than product you got

#### Use a Home Reference Point

Another complication arises because EDM VISION's single-interval error compensation does not use a fixed point as a reference to begin adding/subtracting error correction. Figure 6-8 illustrates this concept.

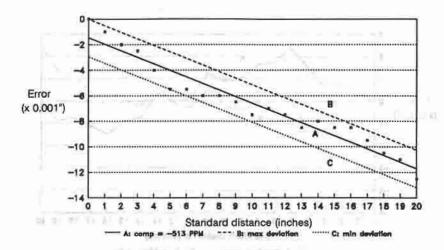


Figure 6-8. The same error correction factor applied from different starting locations

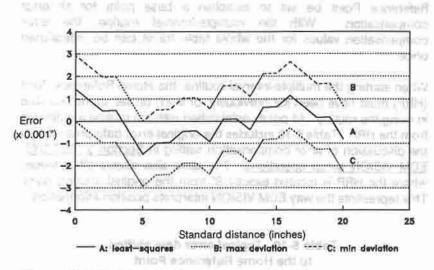
ATTENDED TO STREET A PERSON OF THE PERSON OF

The middle line, marked "A", is the same error correction line established earlier in the discussion of error compensation in Section 3. The residual errors shown in Figure 6-9 are the difference between this line and individual data points.

Once established, the single-interval error correction factor is not referenced to any particular reference point or fixed location; the factor will be applied in the same manner regardless of the starting point. For EDM VISION, this means the point at which the axis measurement is last zeroed.

Consider that the table is moved to a location that corresponds to X=0 on the graph. If the axis measurement is zeroed at this location, the error correction is subtracted from succeeding measurements according to line "B", which is parallel to line "A" and passes through the data point at X=0 (the point at which the residual error is the greatest on the positive side of line "A"). The residual errors with line "B" is much greater than considered when establishing the error compensation along line "A".

The results are shown in Figure 6-9, which compares the residual errors when starting at the "intended" point verses starting at X=0. In fact, error compensation according to line "A" would only be applied if the axis measurement were zeroed at points where error compensation line "A" falls directly on a data point (or that the residual error graph for line "A" is equal to zero; such as at X=3.5, 11, and 12).



inche-dreamy enimiera unitam beyorde-piculara a Milliotte

The enable-billions routher requires and a blance

Figure 6-9. Residual errors when applying single-interval error compensation from different starting points

Similarly, error compensation could be started by zeroing at the point corresponding to X = 5. This involves the greatest residual error on the negative side of line A. Error correction would be subtracted from succeeding measurements according to line "C".

EDM VISION adds/subtracts single-interval error correction based on the current value of the absolute measurement. Location of the error correction line parallel to line A depends on where the absolute measurement display was last zeroed.

The absolute measuring display is usually only zeroed once per setup. The absolute measurement is usually zeroed in the same area from setup-to-setup. The table is seldom moved through its full range during normal EDM operations. These factors tend to minimize the effect of variable offsets to the error correction line with varying locations for the absolute zeroing operation. This example reinforces the need to set error compensation for the area most often used, rather than across the whole table.

Setting a Home Reference Point (set with the encoder's FTO feature) can overcome the majority of compensation offset effects. A Home Reference Point should be selected that is near a zero-error point on the residual error graph. This would limit the offset to a value much less than the extremes shown by lines B and C. In addition, using the selected the Home Reference Point for each setup would prevent changes to the offset.

#### Advanced multiple-interval techniques

EDM VISION's multiple-interval routine eliminates variable-offset complications. The multiple-interval routine requires that a Home Reference Point be set to establish a base point for all error compensation. With the multiple-interval routine, the error compensation values for the whole table travel can be established once.

When starting the multiple-interval routine, the Home Reference Point (HRP) must have been set previously, or it will be set as the first step in using the routine. All points established with the routine are defined from the HRP. Table 6-10 includes the original error data presented in the discussion of error compensation setting in <a href="Section 3">Section 3</a>. SET SYS: <a href="EDM VISION setup operations">EDM VISION setup operations</a>. The table also shows offset values where the HRP is located exactly 8" from the original starting point. This represents the way EDM VISION interprets position information.

Table 6-10. Typical error data shifted to the Home Reference Point

is tetrality etomic envision economics of the

Standard distance (inches)	EDM VISION distance (inches)	Actual distance from Home Ref. Point (inches)	Error (x .001")	Error normalized to Home Ref. Point (x .001")
0.0000	0.0000	-8.0000	0.00	6.00
1.0000	1.0010	-7.0000	-1.00	5.00
2.0000	2.0020	-6.0000	-2.00	4.00
3.0000	3.0025	-5.0000	-2.50	3.50
4.0000	4.0040	-4.0000	-4.00	2.00
5.0000	5.0055	-3.0000	-5.50	0.50
6.0000	6.0055	-2.0000	-5.50	0.50
7.0000	7.0060	-1.0000	-6.00	0.00
8.0000	8.0060	0.0000	-6.00	0.00
9.0000	9.0065	1.0000	-6.50	-0.50
10.0000	10.0075	2.0000	-7,50	-1.50
11.0000	11.0070	3.0000	-7.00	-1.00
12.0000	12.0075	4.0000	-7.50	-1.50
13.0000	13.0085	5.0000	-8.50	-2.50
14.0000	14.0080	6.0000	-8.00	-2.00
15.0000	15.0085	7.0000	-8,50	-2.50
16.0000	16,0085	8.0000	-8.50	-2.50
17.0000	17.0095	9.0000	-9.50	-3.50
18.0000	18.0105	10.0000	-10.50	-4.50
19.0000	19.0110	11.0000	-11.00	-5.00
20.0000	20.0125	12.0000	-12.50	-6.50

Using the multiple-interval error compensation routine can also introduce complications. If intervals are established without regard to the error measurements, the resulting compensations may not be as accurate as possible. As with single-interval error compensation, the data points used to establish the compensation factors must be "reasonable" for the intervals picked.

Figure 6-10 shows intervals that were established by examining the error data. The intervals selected here were for X = -8 to -3, -3 to +8, and +8 to +12. Error compensation lines were again established using math techniques. The resulting compensations are very good

approximations for the data.

#### Select points to establish error correction intervals

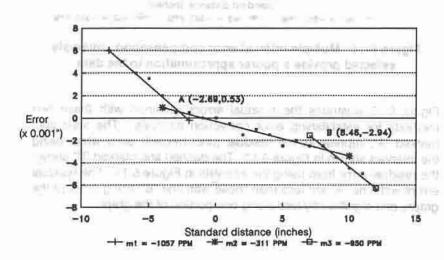


Figure 6-10. Multiple-interval error compensation. Intervals selected provide a good approximation to the data

Note that the X-axis measurements have been offset from the earlier graphs, so that the current X-axis zero point (the location of the Home Reference Point) is at X=8 on the original graphs. The error values have also been offset vertically or "normalized", so that the error value for the current X=0 position has been set to zero. This set of data will be used for all multiple-interval error compensation examples.

Figure 6-11 also illustrates three-interval error compensation; here intervals were selected to be roughly equal in length, without examining the error graph. The intervals selected are for X = -8 to -2, -2 to +5, and +5 to +12. This error compensation is not as good as that shown in Figure 6-10.

abotheri nettarius levelus (F. spill Toog)

A DESCRIPTION ASSOCIATION OF THE PROPERTY OF T

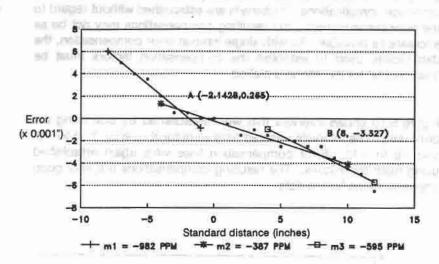
sides in the real constitution. The realism sealigns somewhat in this

and investigations with an earliest the professor which the same through

VISION's automatic applicainterest purious

AUCIONI

FOR AUCIONI



patie tapo lietagos tilettelesagelian some paveles estetture

Figure 6-11. Multiple-interval error compensation. Intervals selected provide a poorer approximation to the data

Figure 6-12 illustrates the residual errors obtained with these two methods for establishing error correction intervals. The solid line, marked "A", represents the residual (uncorrected) error when using the intervals shown in Figure 6-10. The dashed line marked "B" shows the residual error from using the intervals in Figure 6-11. The residual errors with line "A" are less than those with line "B" along most of the graph, and significantly less along one portion of the graph.

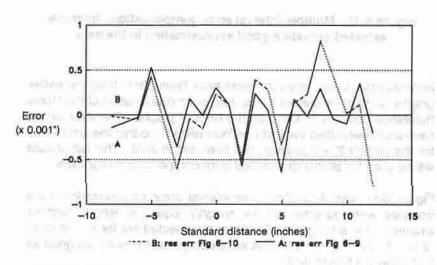


Figure 6-12. Residual errors found with "good" (line A) vs. "poor" (line B) interval selection methods

The results of using EDM VISION's automatic multipleinterval routine

School (Property States)

EDM VISION

Using EDM VISION's automatic multiple-interval routine can result in an additional complication. The routine assigns compensation factor intervals based on establishing two points within each interval; but applies a method for selecting interval intersections and generating a continuous error compensation that can give unexpected results. Figures 6-13 through 6-15 illustrate this situation.

Figure 6-13 illustrates three intervals that were established by examining the error data, and picking two points for each interval. The intervals shown would minimize residual errors. The automatic routine is used to establish the points and intervals to EDM VISION.

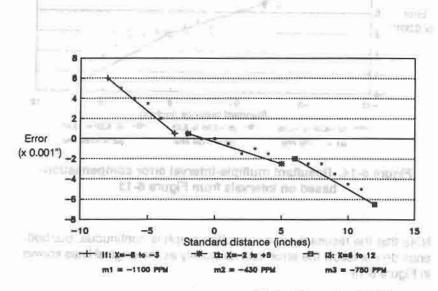


Figure 6-13. Three intervals established by using EDM VISION's automatic routine

Note that the interval error compensation lines are not connected; there is no error correction factor established at this point in the spaces between the adjacent error compensation lines. EDM VISION applies built-in formulas to adjust the error compensation intervals and values to obtain a continuous error compensation equation. Figure 6-14 shows the results.

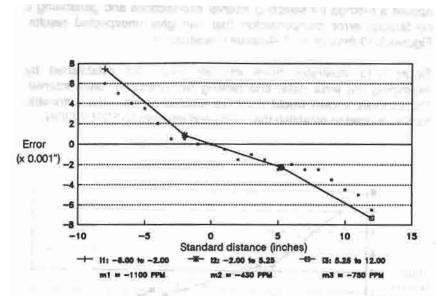


Figure 6-14. Resultant multiple-interval error compensation based on intervals from Figure 6-13

Note that the resultant error correction graph is continuous, but both ends do not follow the error data as closely as the original lines shown in Figure 6-13.

WAT DOWN OF THE BUILDING STREET, ALL AND DES

A Ser off a real neglection of a real of the real of the service o

Figure 6-15 compares the residual errors from the intended error compensation lines from Figure 6-13 (line A) and the actual error compensation lines from Figure 6-14 (line B) after completing the EDM VISION automatic multiple-interval error compensation routine. Residual errors along the middle interval follow fairly closely, but the residual errors from the compensation set with the automatic routine are significantly larger at either end.

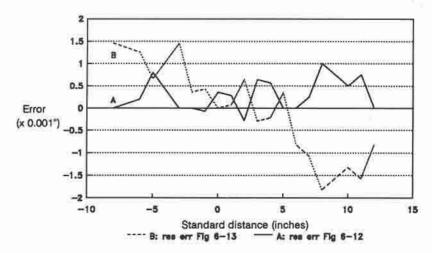


Figure 6-15. Residual errors produced by using EDM VISION's automatic multiple-interval routine from Figure 6-14, compared with intended compensation from Figure 6-13

These complications can be dealt with, but it is essential that the operator be aware of them. The operator must have sufficient data to establish the shape of the machine geometry error graph for the entire table travel, for comparison to the error corrections established with the automatic routines.

The operator can re-measure the table errors with the error compensation in place to confirm that the error compensation that has been applied is within acceptable limits. The operator can also use the editing features to establish the error correction factors and intervals directly, based on manually-determined intervals and error correction factors, so that he is assured of the results.

Compare the resulting error compensation

### ABSOLUTE - The measurement of total distance moved along an axis from a fixed datum point.

- CRT Acronym for Cathode Ray Tube; main viewing screen of the unit.
- CPU (CENTRAL PROCESSING UNIT) The integrated circuit which provides control of memory and computational functions.
- CHECKSUM VALUE A summation of bits or digits. Primarily used for checking ROM (Read Only Memory) computer memory to insure it has not been altered.
- CURSOR A movable "pointer" which indicates where entries or actions will take place. For EDM VISION, the cursor is a highlighted block.
- DIRECTION POLARITY The assignment of a + or value to a direction of motion along an axis. This assignment is based on shop standards or operator's choice.
- DMS Degrees-minutes-seconds angular measurement units.
  One form of radial measurements used by EDM VISION. The other angular measurement unit used by EDM VISION is decimal degrees (DEG).
- FIDUCIAL TRIGGER OUTPUT (FTO) A pulse generated when a fiducial (reference) mark on a glass scale is sensed by the encoder reading head. The FTO signal is used to relocate workpiece zero after a power interruption and it is used to define the interval locations when using Multiple Error Compensation.
- FREEZE To hold an axis display with its current value, not allowing it to be changed by incoming encoder information.
- INCREMENTAL A measurement indicating a distance from the current tool position to a desired tool position (point to point). Incremental moves comprise the absolute measurement (parts make up the whole).
- MICROPROCESSOR The control and processing portion of a small computer.
- RAM Acronym for Random Access Memory. This "temporary" memory holds information and programs during processing.
- REFERENCE PRESET Sets the incremental display to the distance and direction required to move to a desired position which is referenced from the axis absolute zero point.
- RESOLUTION The smallest (or least count) unit of motion that a readout system is capable of measuring and displaying.
- ROM Acronym for Read-Only Memory. A storage arrangement for information retrieval only. This "permanent" memory contains operational instructions.

# Appendix H. Glossary



- RS232-C A type of serial communication. When this capability is supplied with the readout, it allows communications in both directions, between the readout and computer or other peripheral device.
- SOFTWARE Programs, routines, codes, and other written information which communicate commands to a computer.
- **TACTILE** A type of key, that when pressed, can be felt to "snap". The snap indicates to the user that the input was accepted.
- TAPER The gradual reduction in the diameter of a cylindrical part along an axis.
- THAW The menu key which will cancel a frozen display. See FREEZE.
- TTL Acronym for Transistor-Transistor Logic. Family of logic circuit designs found within digital electronics.

22 SPACE AT \$1 DOE VANDOTTERMENT WANTED IN HOTEL STATE SHARE SHARES WANTED AND THE STATE SHARES WANTED TO SHARES WANTED STATE SHARES WANTED SH

restantes. Tables es particol verseguare est una gelacon.

seu reconstituta a est accionation formano aper de 1.50/04202345000.

a multiple promoting fem is not self. ADSPED Cardelle 4.

physicial bring not all to being a 2 700 or 100 or

AND RESERVE AND ADDRESS OF THE PROPERTY OF THE

25 Contraction of the contraction of the VIVIN VIVIN The

SORRY IN NORMANY IN SERVED WHITE THE

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions in this manual, may cause interference to radio communications. It has been tested and found to comply with the limits in effect at the time of manufacture for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

# Appendix I. Warranty FCC compliance statement

ACU-RITE products and accessories are warranted against defects in material and workmanship for a period of one year from the date of purchase. ACU-RITE will, at its option and expense, repair or replace any part of the ACU-RITE product which fails to meet this warranty. Notice of the claimed defect must be received by ACU-RITE within the warranty period.

This warranty applies only to products and accessories installed and operated in accordance with this reference manual. ACU-RITE shall have no obligation, with respect to any defect or other condition caused in whole or part by the customer's incorrect use, improper maintenance, modification of the equipment, or by the repair or maintenance of the product by any person except persons deemed by ACU-RITE to be qualified.

Responsibility for loss in operation performance due to environmental condition, such as humidity, dust, corrosive chemicals, depositions of oil or other foreign matter, spillage, or other conditions beyond ACU-RITE's control cannot be accepted by ACU-RITE.

There are no other warranties expressed or implied, and ACU-RITE INCORPORATED shall not be liable under any circumstances for consequential damages.

manager and the second second

The ACU-RITE warranty

### 30-day Red Carpet warranty service

FCC compliance

VARIATION OF PROJUCT

toemeters

#### **IMPORTANT**

Keep the box and packing materials.

Your ACU-RITE EDM VISION readout is covered by a 30-day Red Carpet Warranty Service. If in the first 30 days this product fails for any reason, repack it in the original packing materials and contact the distributor or OEM from whom you purchased it for return instructions.

For future following in	ordering information or warranty service, record the iformation:
EDM VISION	serial number (located on bottom of unit):
Software vers	ion/date (from opening display):
Configuration	(press the [ SET SYS ] key, then the < MISCELLANEOUS >,
	>, and < HARDWARE IDENTIFICATION > menu keys):
EDM	VISION CPU Module
SECTION COLUMN	CPU I.C. U6: Property and mer appropriate of the party of the contract of the
	CPU I.C. U7: NOT THE THE TANK OF THE PROPERTY OF THE
	CPU I.C. U8:
	VIDEO I.C.:
Dual	Axis Module:
1 Axis	Module (CFI):
Other	
	And it was appeared that collected in their left frequencies.
to another	The state of the s
Encoder catal	og and serial numbers:
X-axis:	State Of the September
Y-axis:	
Z-axis:	JARN DRIEBLE NO DONES LIVE BORGERINGS TRUE DE DIE DIE BERNE
W-axis:	VICENSIAND THAT NOT BY SKINE WINDS BUT THERES
Date of purch	ase:
Distributor:	
Address:	
Telephone	9: