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Quick Start

Quick Start

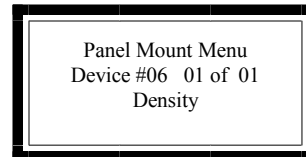
Quick Start

Quick Start using Panel Mount Programmer

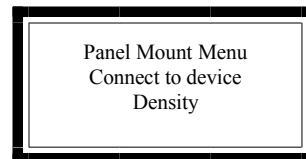
Procedures to Install, Reference and Calibrate the X99

- 1) Unpack and mount the equipment. See chapter 3 Configuration Drawings for more details.
- 2) Wire the microprocessor and detector. See chapter 4 the last page for the interconnect diagram.
- 3) Turn the Power Switch to the ON position from the Power Supply Module.
See Power Supply Module in chapter 4 for more details.
- 4) Press the “MODE” key on the PMP (Panel Mount Programmer) to turn on the display.
- 5) Press the “OK” key to “Scan for Devices”.
- 6) Press the “OK” key to Devices found = 01.

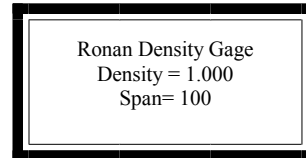
- 7) Press the “OK” key to



- 8) Press the “OK” key to “Connect to device”



- 9) This Screen is called the Status Screen



- 10) Press any of the top four keys on the PMP to exit the Status Screen and this will allow you access to the “Enter Access Code” screen..

Enter in the access code “1 2 1 3 2 3”

Now you can access the Menu Variables screens to Reference Low and Calibrate High.

Next Page



Performing a Low Reference:

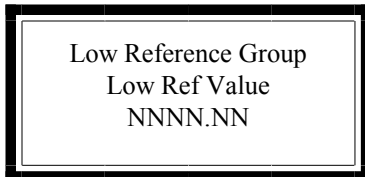


Figure 9a: The Low Referencing Value

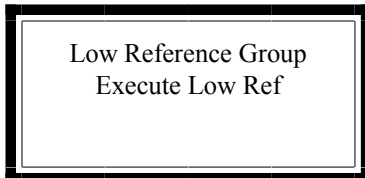


Figure 9b: Executing Low Ref:

Make sure the Vessel is filled with low density under normal operating conditions.

- 1) Press the “Open” key to the “Low Reference Group”
- 2) Toggle the “Next” key until you reach “Low Reference Value” Menu, Figure 9a, and set the value to the desired Low Reference Value. (See Chapter 6 pages 1-3 on modifying Menu Variables).
- 3) Toggle the “Next” key until you reach the “Execute Low Ref” Menu, Figure 9b, and press the MODify key, and follow the two remaining prompts. (Continue, Ready)

Performing a High Calibrate:

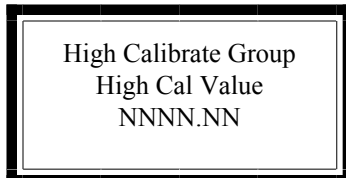


Figure 10a: Entering the High Calibration Value.

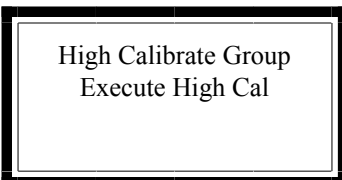


Figure 10b: Executing the High Calibration Variable.

- 1) Fill the vessel above the full range of measurement.
- 2) Toggle the “Next” key until you reach the “High Calibrate Group” Press the “Open” key
- 3) Toggle the “Next” key until you reach “High Cal Value” Menu, Figure 10a, and set the value to the desired High Cal Value. (See chapter 6 on modifying Menu Variables).
- 4) Toggle the “Next” key until you reach the “Execute High Cal” Menu, Figure 10b, and press the MODify key, and follow the two remaining prompts. (Continue, Ready)
- 5) Press the “Exit” key and return the Status screen.

Repeat the reference and calibration if the X99 does not indicate zero when the vessel is emptied, or if the X99 does not indicate full with the process covering the complete measurement range.

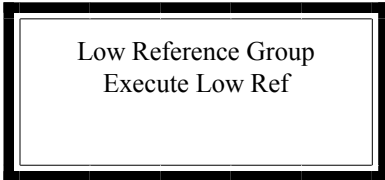


Figure 9a: Executing Low Ref:

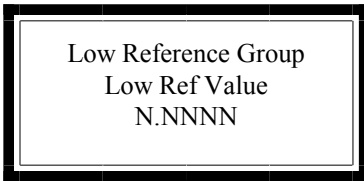


Figure 9b: The Low Referencing Value

Performing a Low Reference:

Make sure only water is flowing through the pipe!

- 1) Toggle the “Next” key until you reach the “Low Reference Group” Press the “Open” key
- 2) Toggle the “Next” key until you reach the “Execute Low Ref” Menu, Figure 9a, and press the MODify key, and follow the two remaining prompts. (Continue, Save)
- 3) Toggle the “Prev” key until you reach “Low Reference Value” Menu, Figure 9b, and set the value to 1.00 SpG or the desired Low Reference Value. (See chapter 9 on modifying Menu Variables).

Performing a High Calibrate:

1/uT METHOD:

Rather than to Calibrate High on a heavy SpG, the Transmission constant can be manually calculated and keyed in.

Transmission Constant = $1 / \mu T$
 and μ = absorption coefficient (=0.2)
 T = pipe’s inner diameter (in inches)

Example
 4 inch pipe id
 Transmission Constant = $1 / (0.2 \times 4) = 1.25$

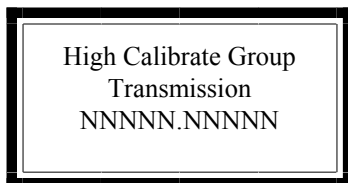


Figure 11a: Entering the Transmission Constant manually

- 4) Toggle the “Next” key until you reach the “High Calibrate Group” Press the “Open” key
- 5) Toggle the “Next” key until you reach the “Transmission Constant” Menu. Press the MODify key. Set the value to the correct value. (See chapter 9 on modifying Menu Variables).
- 6) Press the “Exit” key and return the Status screen.

Auto-Reference (Optional)

Procedures to Auto-Reference the X99 microprocessor for Low Level.

Make sure the Source's Shipping-cover has been removed from the front of the source holder.



Before performing a Auto-Reference:

Make sure the vessel is emptied under normal operating conditions!

- 1) Make sure the vessel is empty under normal operating conditions.
- 2) Locate the Auto-Reference pushbutton and the Auto-Reference indication. Hold pushbutton for 3 to 5 seconds until the Auto-Reference indication turns on. Continued to run the vessel in the empty condition until the Auto-Reference indication turns off.
- 3) X99 Level output should indicate zero (example: 4.00 mA or 0 VDC). If not repeat steps 1 & 2 again.
- 4) Auto-Referencing (the zero) is complete.

Specification Sheets
Specification Sheets
Specification Sheets



SPECIFICATIONS: *X99 Density Monitors*

Consists of Microprocessor, Power Supply, I/O Modules, Panel Mount Programmer and chassis. Accepts input signal(s) for Density monitor from either ion chamber or scintillation detector and provides linear, isolated output(s) for recording or control. Internal RS485 communications loop for additional functions such as Temperature Compensation, Digital Outputs, Analog Outputs, etc. Addition of modules requires simple connection of four wires to implement. Software features include Source Decay Compensation, Dynamic Process Tracking and Self-diagnostics. The X99 Computer may be located locally at the detector or remotely to a more convenient location.

POWER SUPPLY MODULE

Part Number	PWRSPLY-16018
Type.....	High-efficiency switching
Input Voltage	85 to 265VAC or 24VDC
Output Voltage	+5VDC
Output Current.....	3 A max.
Input Interface	3 term. strip
EMI/RFI Protection	Integral line filter
Output Interface.....	plug-in term strip
Output Protection	Short-circuit proof-auto recovery

CPU MODULE

Part Number	MOD-15133
Power required	+5VDC @ 100mA
Microprocessor	80188 10MHz
Memory.....	Prom,non-volatile RAM
Intermodule communications	RS485
Module comm. interface	term. strip
Max. Modules	32 (RS485 limit)
Communications.....	RS485
Remote comm interface	term. strip
Maximum cable length	4000ft (1200m)
Power to Hand-held prog.....	+5VDC
Local comm interface.	RJ-11 conn
Alarm Outputs	
Power Fail Relay	SPST
Contact Rating.....	1A / 24VDC 0.5A / 120VAC
Communications Error Alarm	SPST
Contact Rating.....	1A / 24VDC 0.5A / 120VAC

INPUT MODULE (ION CHAMBER) ◆

Part Number	MOD-15180
Input.....	Analog, 0-5VDC
Input interface	Plug-in term .strip
Output power	±15VDC @ 30 mA to detector
Output interface	Plug-in term strip
Internal communications.....	RS485 to CPU

INPUT MODULE (SCINTILLATOR) ◆

Part Number	MOD-14397
Input.....	Pulse
Input interface	Plug-in term .strip
Output power	+18VDC @ 30 mA to detector
Output interface	Plug-in term strip
Internal communications.....	RS485 to CPU

OUTPUT MODULE (ANALOG)

Part Number	MOD-14403
Isolated output	0-10VDC @ 20mA or 0-20mA into 1000Ωmax.
Function	Programmable
Interface.....	Plug-in term strip
Isolation type.....	Optoelectronic
Isolation voltage.....	300 VDC
Internal communications.....	RS485 to CPU

◆ Only (1) used per gage

Gage Components
Gage Components
Gage Components

Components LIST

X99 Density system perform measurements for numerous applications. Below is the List of the individual components that are unique to the X99 ordered. Keep this List handy, as it will be referenced numerous times in the following manual.

Item	Quantity	Part Number	Name
(1)	1	X99DEN-AS01-01N	X99 Processor (see below)
(2)	1		Scintillator Detector
(3)	1	CBLE-7333-50	Interconnect Cable
(4)	1	PMP-17424	Panel Mount Programmer (PMP)

The Individual X99 Processor Contains:

- 1) CPU Module
- 2) Power Supply
- 3) 1 Scintillator Detector Module
- 4) Enclosure
- 5) Analog Output Module ()
- 6) Digital Output Module ()

These functions are to be enabled at setup:

Extracting Information from the X99 Processor:
 With Panel Mount Programmer (PMP)

X99 Density Components:

X99 Processor:



The CPU, power supply, and all I/O Modules for receiving and analyzing data from the detector are located in the X99 Processor. Operator Interface is via the Ronan Panel Mount Programmer.

Interconnect Cables: Detector to X99 Processor

The Processor may be located remotely or locally relative to the detector. The length of the Interconnect Cable may be specified up to 5000 feet. It should be continuous (containing no splices) and run in conduit or cable trays with instrument cable only. Cables should be routed away from any high current or high voltage device. Interconnect drawings are provided.

Panel Mount Programmer



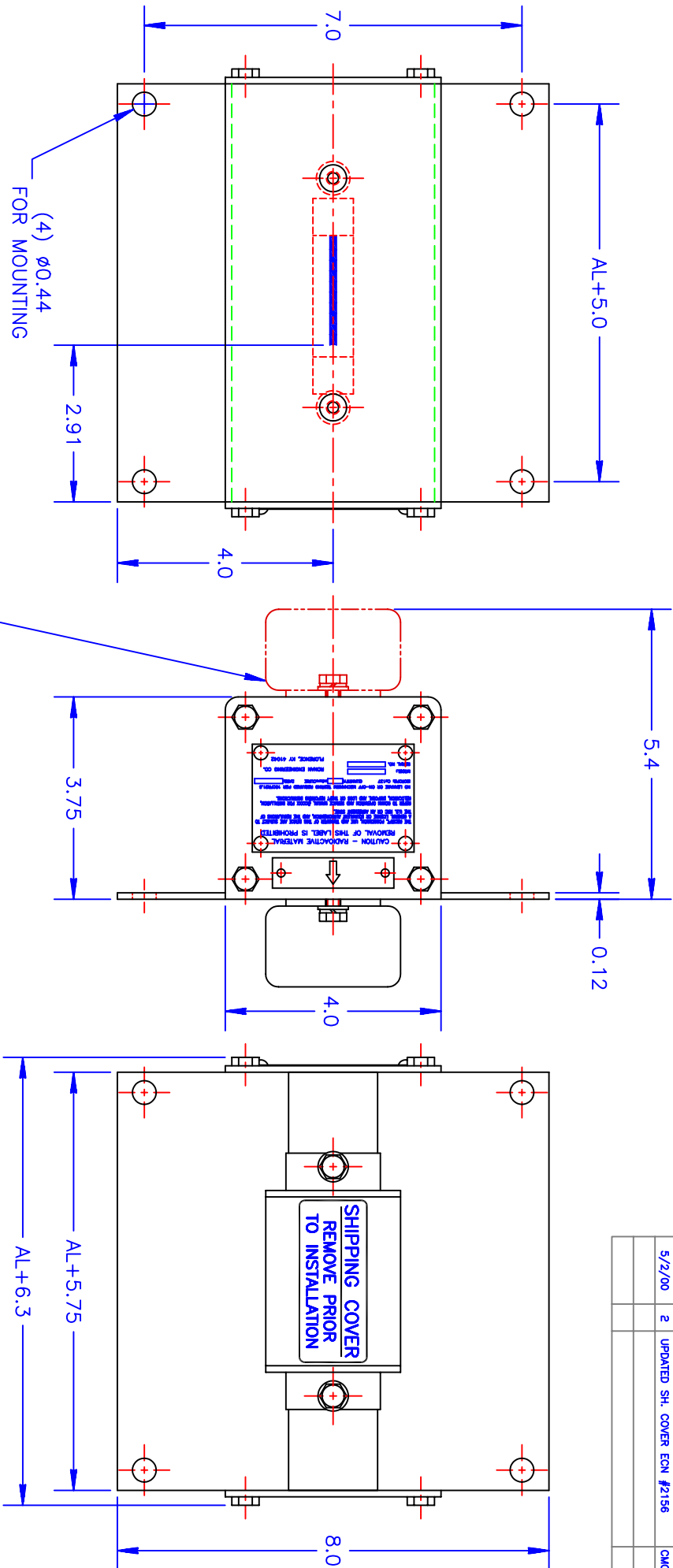
The Panel Mount Programmer (PMP) is used to query and calibrate the X99 Processor.

Access to the processor is via the push buttons on the face of the programmer. The programmer itself is located in the door panel of the Nema-4 enclosure that houses the X99 Microprocessor.

Configuration Drawings

Configuration Drawings

Configuration Drawings



DATE	SYM	REVISION RECORD	DR	CK
11/25/98	0	NEW RELEASE	AVP	
3/1/99	1	ADDED ESTIMATED WEIGHT	YSP	
5/2/00	2	UPDATED SH. COVER ECN #2156	CMC	



MEASUREMENTS DIVISION

CUSTOMER:

SCALE

DR. BY AVP

TITLE

OUTLINE:

LOW LEVEL SOURCE HOLDER

DATE

11/25/98

DRAWING NUMBER

B-16210-K

REV.

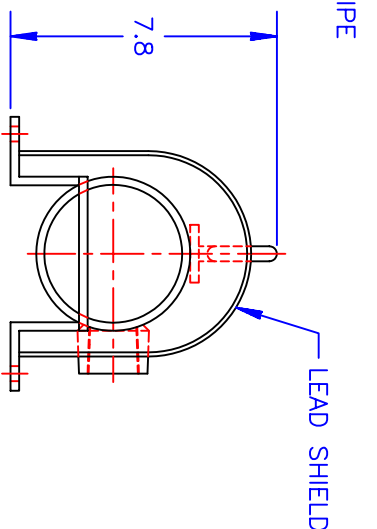
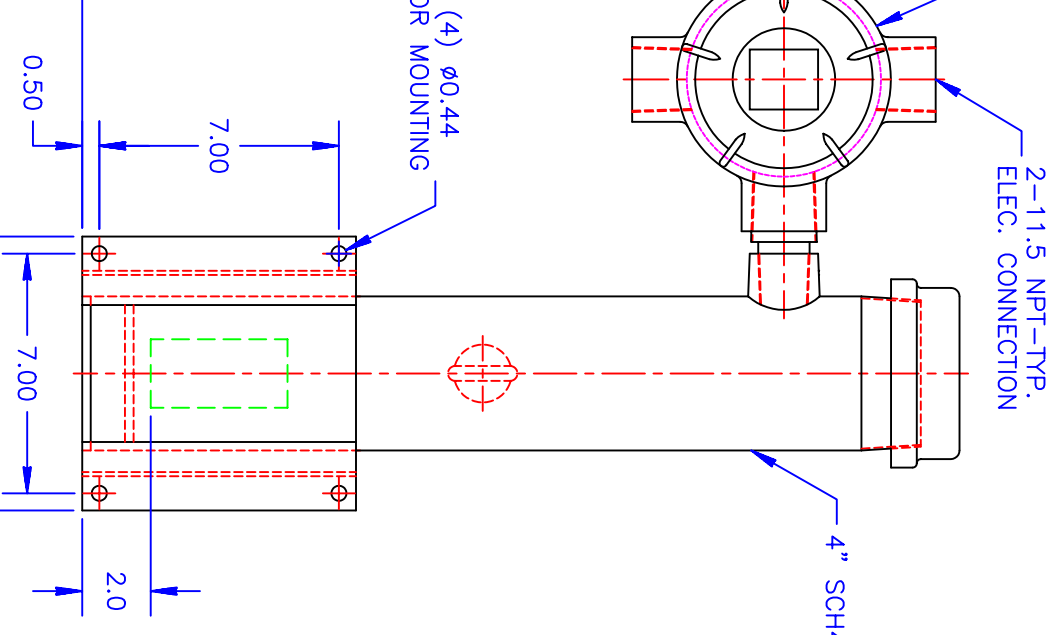
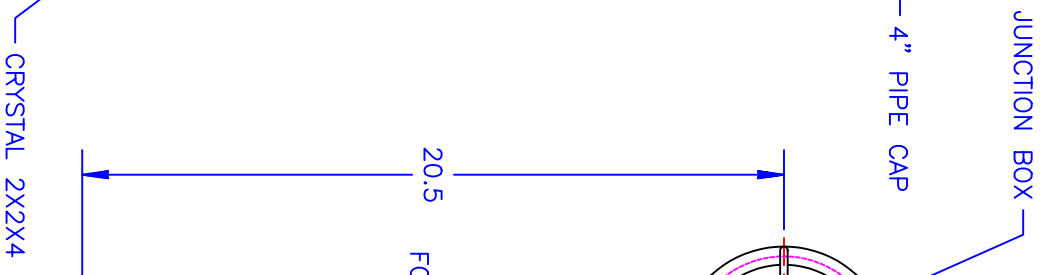
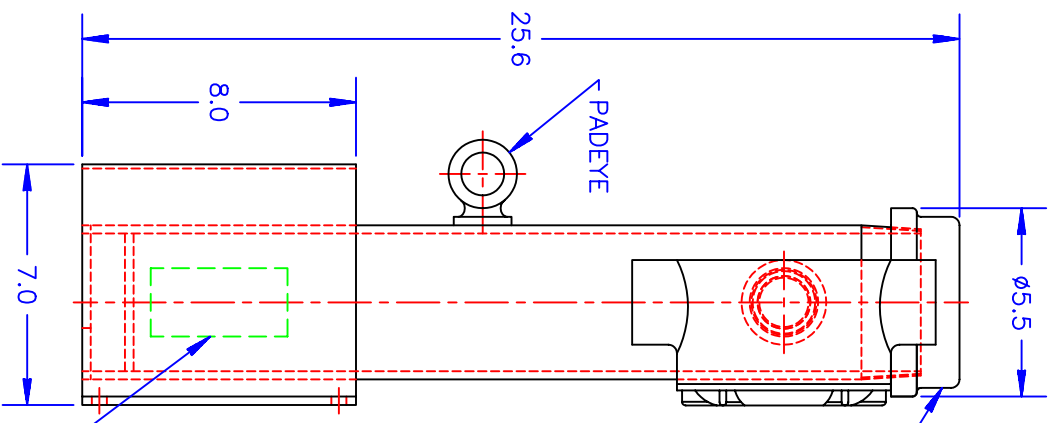
2

ESTIMATED WEIGHT:

W/O LEAD = (2.6 X A.L. + 14.8) LBS

W/ LEAD = (2.6 X A.L. + 14.8) LBS + (3.51 X A.L. + 16) LBS + (1.1 X A.L. + 1.3) LBS

FOR FABRICATION SEE DRAWING D-16195-K



DATE	SYM	REVISION RECORD	DR	CK
10/23/00	0	NEW RELEASE: ECR #2868	AVP	



CUSTOMER: _____ SCALE: 1:4 DR. BY: AVP
 APPR. BY: _____

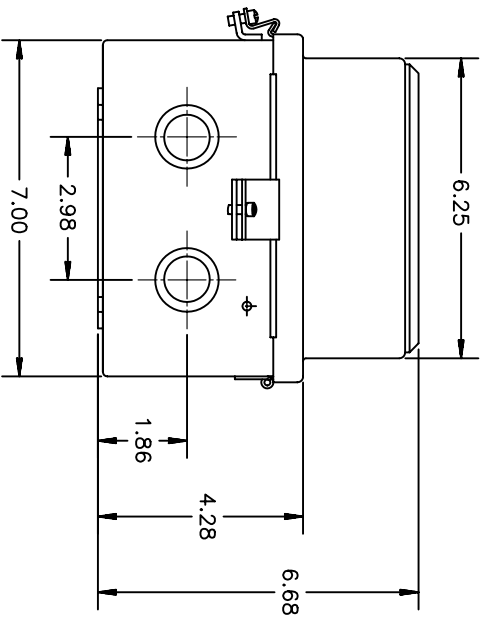
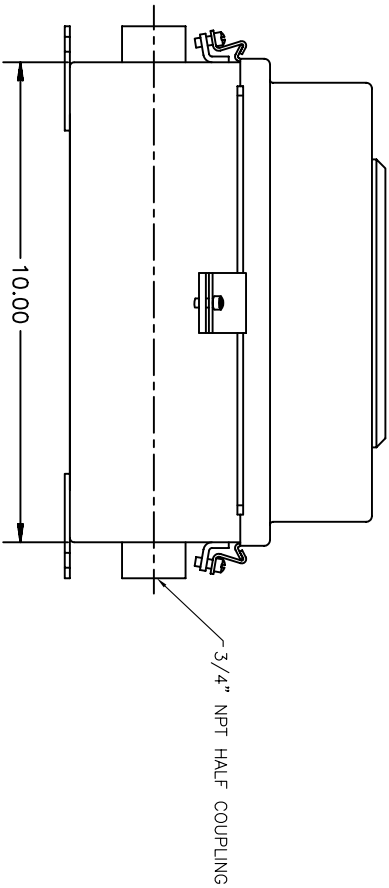
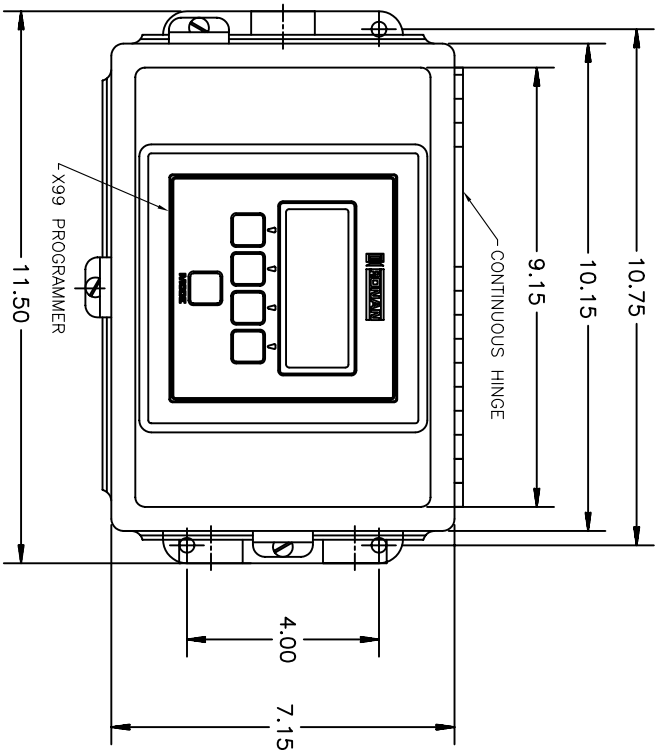
TITLE: OUTLINE: DETECTOR HOUSING (2X4),
 W/ HEATER CONTROLLER

DATE: 10/23/00 DRAWING NUMBER: B-18459-K REV. 0

ESTIMATED WEIGHT = 80 LBS

FOR ASSEMBLY SEE DRAWING D-18458-K

DATE	SYMBOL	REVISION RECORD	DR	CHK
1/15/01	0	INIT RELEASE PER ESM #2313		CMC



FOR ASSEMBLY SEE DRAWING D-18388-K



CUSTOMER:		SCALE:		DR. BY/CMC	
TITLE:		1:1		APPR. BY	
OUTLINE: ENCLOSURE, X99 NEMA 4					
W/PANEL MOUNT PROGRAMMER					
DATE:	DRAWING NUMBER:	REV.:			
1/15/01	C-18574-K	0			

Module Descriptions
Module Descriptions
Module Descriptions

Ion Chamber Input Module Description

The Ion chamber Input module is the analog detector input to the Ronan Intelligent Detector systems.

The Ion Chamber Input module supplies $\pm 15\text{VDC}$ to the detector for power and receives the voltage signal from the detector that represents the strength of the radiation field applied to the detector. The system can accept a voltage of 0 VDC to 5 VDC .

This module is microprocessor-based with an RS-485 communications interface, and the RNET proprietary protocol. The module's communications address is normally preset at the factory, but is field selectable.

Ion Chamber Input Module Specifications

Power:	+5 VDC \pm 5%, 75 mA maximum
Communications:	Single RS-485 multi-drop communications channel
Temperature:	-40 to +75°C
Humidity:	0 - 95% non-condensing
Vibration:	
Input Range:	0 - 5 VDC
Outputs:	$\pm 15\text{VDC}$ for detector power
Resolution:	15 bit (0 - 32767 counts)
Calibration:	Factory Pre-calibrated; No field calibration required.

Ion Chamber Input Module

	<u>Pin Number</u>	<u>Description</u>
Blk	10	-15 VDC to Ion Chamber
Red	9	+15 VDC to Ion Chamber
Grn/Wht	8	Shield
Blu	7	FeedBack Control
Grn	6	Ion Chamber Signal Common
Yel	5	Ion Chamber Signal Input
	4	RS-485 -D (from CPU)
	3	RS-485 +D (from CPU)
	2	5 VDC Ground (from Power Supply)
	1	+5 VDC (from Power Supply)

Scintillator Input Module Description

The Scintillator Input module is the digital pulse detector input to the Ronan Intelligent Detector systems.

The Scintillator Input module supplies +18VDC to the detector for power and receives the digital pulses from the detector that represent the strength of the radiation field applied to the detector. The system can accept a value of 32767 maximum each scan. Normally, the Ronan detectors are well within this limitation.

The module can be calibrated for the Count Period (typically matches the gage's scan time of 400 mS), and Prescale Divider (to divide the counts down - typically set to one).










This module is microprocessor-based with an RS-485 communications interface, and the RONET proprietary protocol. The module's communications address is normally preset at the factory, but is field selectable.

Scintillator Input Module Specifications

Power:	+5 VDC \pm 5%, 75 mA maximum
Communications:	Single RS-485 multi-drop communications channel
Temperature:	-40 to +75 °C
Humidity:	0 - 95% non-condensing
Vibration:	
Input Range:	Digital pulses up to 1MHZ in frequency.
Outputs:	+18VDC for detector power
Resolution:	15 bit (0 - 32767 counts)
Calibration:	Factory Pre-calibrated; Field calibration capable.

Scintillator Input Module

Pin Number Description

Green/White	9		Shield to Scintillator
	8		Isolated Ground
Red	7		+18 VDC to Scintillator
Blk	6		Scintillator Signal Common (-)
Wht	5		Scintillator Signal Input (+)
	4		RS-485 -D (from CPU)
	3		RS-485 +D (from CPU)
	2		5 VDC Ground (from Power Supply)
	1		+5 VDC (from Power Supply)

Analog Output Module Description

The Analog Output module is used for voltage or current output from the Ronan Intelligent Detector systems. A switch on the module selects either voltage or current output.

This module produces an isolated voltage of from 0 - 10 VDC, or an isolated current from 0 to 20 mA. The module can be calibrated for any voltage or current within the above limits by setting the Zero and Span in the calibration procedure. Zero and Span values can also be inverted (Zero = maximum input value, Span = minimum input value).

The Analog Output module also incorporates a Failure Mode of operation, where the output from the module can be specified in the event of an I/O communications failure. This mode can be selected during the calibration procedure to be Hold or Specific Value. In the Hold mode, the last valid value received by the module will be maintained until either power is removed from the module, or communications is restored. In Specific Value mode, you select a percent of full scale output to be maintained during communications failure.







The module is microprocessor-based with an RS-485 communications interface, and the RNET proprietary protocol. The module's communications address is normally preset at the factory, but is field selectable.

Analog Output Module Specifications

Power:	+5 VDC \pm 5%, 75 mA maximum
Communications:	Single RS-485 multi-drop communications channel
Temperature:	-40 to +75°C
Humidity:	0 - 95% non-condensing
Vibration:	
Output Range:	Isolated 0 - 20 mADC (switch selectable between mA and V) Isolated 0 - 10 VDC
Max Output Load:	1,000 Ω
Resolution:	12 bit
Accuracy:	\pm 1/2 LSB over full range
Calibration:	Factory Pre-calibrated; Field calibration capable.

Analog Output Module

<u>Pin Numbers</u>	<u>Description</u>
--------------------	--------------------

6	 - Output
5	 + Output
4	 RS-485 -Data (from CPU)
3	 RS-485 +Data (from CPU)
2	 5 VDC ground (from Power Supply)
1	 +5 VDC (from Power Supply)

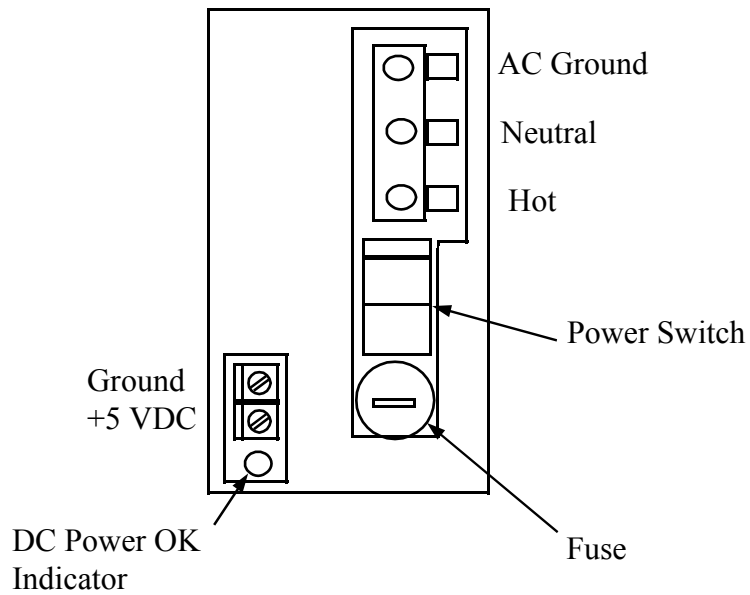
AC Power Supply Module Description

The Power Supply module supplies the +5VDC to the modules housed in the NEMA-4 enclosure attached to the detector.

AC Power Supply Module Specifications

Power Input: 85 - 265 VAC \pm 15%, 15 watts
 Power Output: +5VDC, 3A maximum
 Temperature: -40 to +75°C
 Humidity: 0 - 95% non-condensing
 Vibration:
 Fuse: 250 Volt, 3.15A, 5x20mm

Power Supply



CPU Module Description

The CPU module is the computer module for the Ronan Intelligent Gage Systems. It incorporates the micro-processor, PROM program memory, non-volatile RAM data memory, and communications.

Two relays provide alarm outputs for the detection of power fail and I/O communications errors. The processor is housed in a NEMA-4 enclosure along with the power supply and I/O modules for a particular gage type.

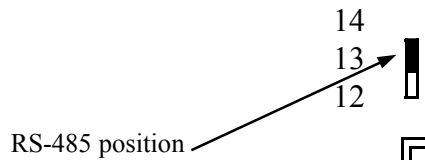


The gage software for the micro-processor contains the Menu Variable Access package, I/O control and monitoring package, and the gage algorithm package. Two communications ports provide RS-485 communications for the handheld and I/O modules using Ronan's RNET proprietary protocol. One can be switched to RS-232 to support the Field Addressable Remote Transmitter modem option. This option permits communications across the 4-20 mA output wires to the handheld programmer.

The module also contains a switch bank for selecting the address (0-31) on the RS-485 multi-drop communications link to the handheld programmer.

CPU Module Specifications

Power Required:	+5 VDC \pm 5%, 90 mA maximum
Temperature:	-40 to +75°C
Humidity:	0 - 95% non-condensing
Vibration:	
Outputs:	Form A relay output for power fail Form C relay output for I/O communications errors RS-485 communications for I/O modules RS-485 communications for handheld programmer RS-232 communications for Field Addressable Remote Transmitter modem Option +5VDC for handheld programmer power
Processor:	10 MHZ 80188 microprocessor
Memory:	128KB PROM memory 2/4/8KB Non-volatile battery-backed RAM (Minimum 10 year battery life. Battery is used only when system is powered down)
Software:	Gage-type dependent.
Options:	I/O modules (gage-type dependent) Field Addressable Remote Transmitter modem - 9600 Bits/Second

CPU Module

<u>Pin Numbers</u>		<u>Description</u>
14		Future Use for modem communications
13		Future Use for modem communications
12		Future Use for modem communications
		RJ-11 connector for Local RS-485 hookup
11		Power-Fail Common
10		Power-Fail N.C. Contact
9		I/O Comm. Error N.O Contact
8		I/O Comm. Error Common
7		I/O Comm. Error N.C. Contact
6		-Data for Remote RS-485 communications
5		+Data for Remote RS-485 communications
4		-Data to I/O boards
3		+Data to I/O boards
2		5 VDC ground (from Power Supply)
1		+5 VDC (from Power Supply)

Relay Out Module Description

The Digital Output module supplies four Form C contacts to the user.

This module is microprocessor-based with an RS-485 communications interface, and the RNET proprietary protocol. The module's communications address is normally preset at the factory, but is field selectable.

Relay Out Module Specifications

Power:	+5 VDC \pm 5%, 70 mA maximum
Communications:	Single RS-485 multi-drop communications channel
Temperature:	-40 to +75°C
Humidity:	0 - 95% non-condensing
Vibration:	
Input Range:	None
Outputs:	4 Form 'C' contacts
Contact Rating:	1A @ 24 VDC .5A @ 120 VAC
Calibration:	Factory Pre-calibrated; No field calibration required.
Indicators:	Red LED: Off - No Power On Steady - Power OK, No Communications Blinking - Power and Communications OK

Relay Out Module Connections

<u>Pin Numbers</u>	<u>Description</u>
16	Output 4 N.C.
15	Output 4 Com.
14	Output 4 N.O.
13	Output 3 N.C.
12	Output 3 Com.
11	Output 3 N.O.
10	Output 2 N.C.
9	Output 2 Com.
8	Output 2 N.O.
7	Output 1 N.C.
6	Output 1 Com.
5	Output 1 N.O.
4	RS-485 -D (from CPU)
3	RS-485 +D (from CPU)
2	5 VDC Ground (from Power Supply)
1	+5 VDC (from Power Supply)

3-30 VDC In Module Description

The Digital Input module is designed to accept discreet digital inputs and send them to the Ronan Intelligent Detector systems.

This module will accept up to four discreet inputs.

This module is microprocessor-based with an RS-485 communications interface, and the RNET proprietary protocol. The module's communications address is normally preset at the factory, but is field selectable.

3-30 VDC In Module Specifications

Power:	+5 VDC \pm 5%, 50 mA maximum
Communications:	Single RS-485 multi-drop communications channel
Temperature:	-40 to +75°C
Humidity:	0 - 95% non-condensing
Vibration:	
Input Range:	3-30 VDC for DC module (4 inputs)
0 Logic:	Max Input Voltage 0.5 VDC
1 Logic:	Min Input Voltage 3.0 VDC
Outputs:	5VDC @ for input excitation
Calibration:	Factory Pre-calibrated; No field calibration required.
Indicators:	Red LED: Off - No Power On Steady - Power OK, No Communications Blinking - Power and Communications OK

3-30 VDC In Module

<u>Pin Numbers</u>	<u>Description</u>
14	Ground
13	+5 VDC Supply
12	Input 4 -
11	Input 4 +
10	Input 3 -
9	Input 3 +
8	Input 2 -
7	Input 2 +
6	Input 1 -
5	Input 1 +
4	RS-485 -D (from CPU)
3	RS-485 +D (from CPU)
2	5 VDC Ground (from Power Supply)
1	+5 VDC (from Power Supply)

X99 Processor Wiring

X99 Processor Wiring

X99 Processor Wiring

X99 Processor Wiring

Loosen the 3 screws on the X99 enclosure and open the top cover. Anywhere between 2 and 8 I/O modules are in the X99, along with the CPU and power supply module (see figure 1). The power supply module will always be on the right, followed by the CPU module. The left most module will most likely be the Detector I/O module. Consult the module description for wiring details. Identify each module and document them on figure 1. Figure 2 shows identification procedures.

Figure 1: The view of the I/O Modules. Each application will have a different number of I/O Modules. There can be up to 8.

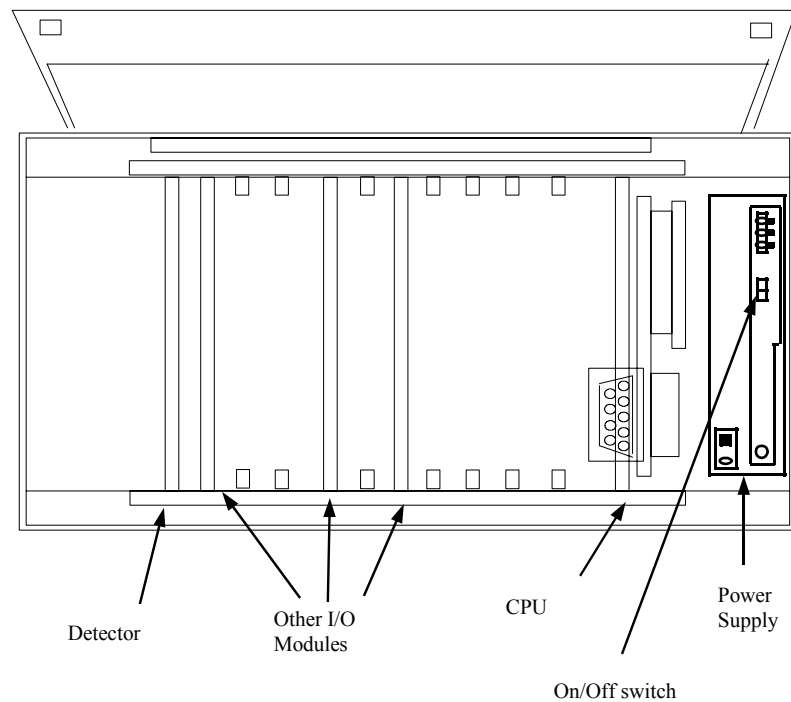
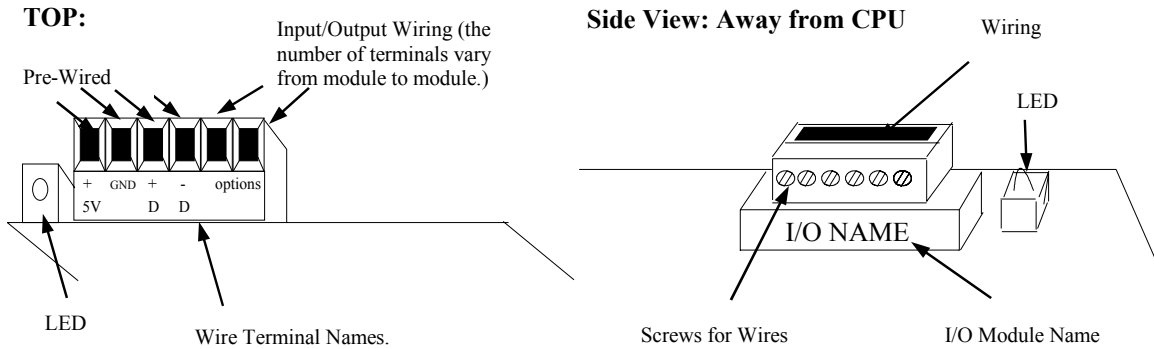


Figure 2: I/O Module Wiring. The top of the module is for wiring. The side gives the Module's name. It also contains the screws to fasten the wire. Check the first four wires for proper connections. These will be pre-wired in the factory (+5 V, Ground, RS-485 (+) and RS-485 (-)). Note: the optional wire outlets may vary in number for each individual I/O Module. There can be anywhere from 2 to 8 additional terminals.



Now, locate the Detector Module, connect the interconnect wires to the Detector Module.

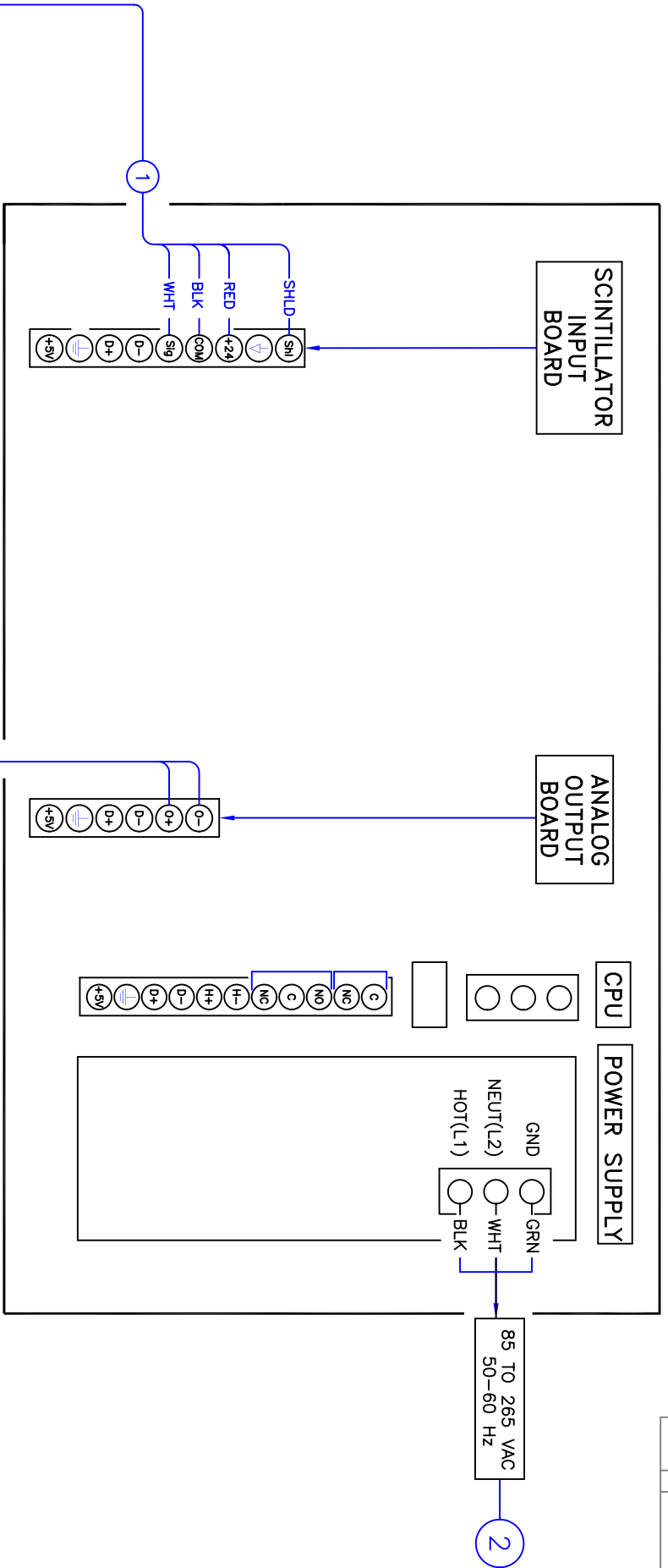
Locate all Input and Output modules and connect the necessary wires that correspond to each module.

Finally, connect the 110 VAC or 220 VAC power supply to the power supply module.

Double check all connections.

It is now safe to turn on the X99 Processor with the switch on the power supply.

X99 COMPUTER



OUTPUT
4-20 mA

- NOTES:
1. USER POWER-85 TO 265VAC, 50-60Hz, PROVIDE SEPARATE EARTH GROUND WHERE REQUIRED.
 2. SIZE CONDUIT PER LOCAL CODE.
 3. CONDUITS SHOULD BE OCCUPIED EXCLUSIVELY BY RONAN CABLE(S).
 4. ALL SHIELDS TO BE TIED TOGETHER AT CABINET EXCEPT mA OUTPUT. MA OUTPUT IS FULLY ISOLATED. MAX. LOAD = 1000 OHMS.
 5. USE WATERTIGHT CONDUIT TO NEMA 4 BOX TO RETAIN ENCLOSURE RATING.

CABLE No	MIN. AWG	NO. OF COND	MFG. & P/N	REMARKS
1	20	3+SHLD	CABLE-7333-L	SUPPLIED W/CONNECTOR MOUNTED
2	16	3		POWER CABLE PER LOCAL CODE

RONAN MEASUREMENTS DIVISION

CUSTOMER: INTERCONNECT WIRING, X99/SCINTILLATOR

SCALE: NTS

DATE: 2/29/00

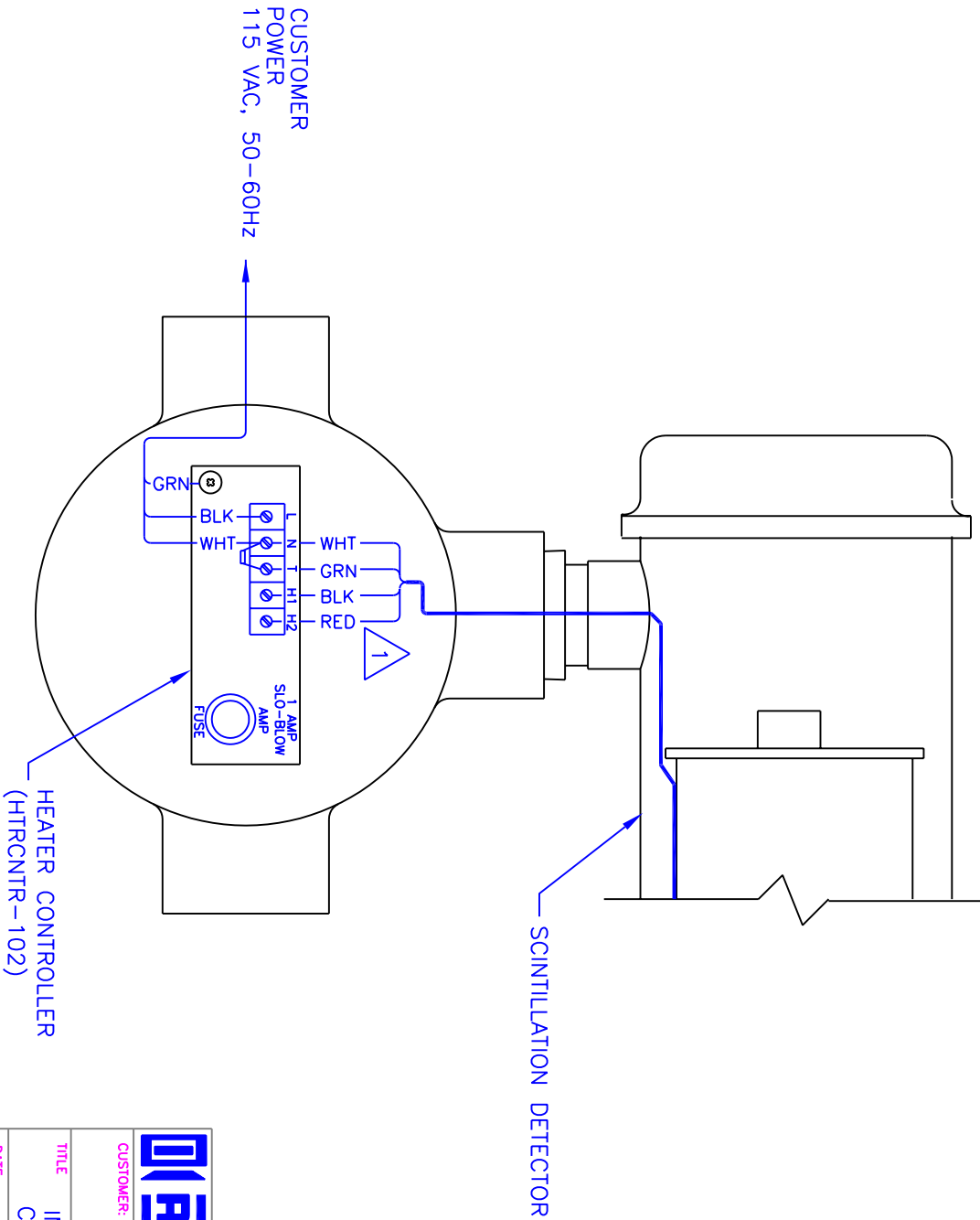
DRAWING NUMBER: C-17661-K

DR: BFC/MC

APPR: BT

REV: 2

DATE	SYM	REVISION RECORD	DR	CK
2/29/00	0	NEW RELEASE, PER ECR #2834		CMC
6/21/00	1	CHG'D TERM. LABELS ECR #2781		CMC
11/17/00	2	REAL DENSITY CALCULATIONS, ECR #2890		CMC



DATE	SYM	REVISION RECORD	DR	C
8/31/99	0	NEW RELEASE. PER ECR #1977	CMC	
9/14/99	1	CORRECTED WIRE CODE. ECR #2480	VSP	
9/23/99	2	CLARIFIED CABLE LOCATION. ECR #2485	VSP	
10/4/00	3	REMOVED ASSY DETAIL	CMC	
4/11/05	4	ADDED AMPERAGE. ECR #3586	AMP	



MEASUREMENTS DIVISION

CUSTOMER:

SCALE: NTS
DR. BY: CMC
APPR. BY:

TITLE

INTERCONNECT WIRING: HEATER CONTROLLER, 115 VAC, TEMP., 110° F

DATE

8/31/99

DRAWING NUMBER

B-16999-K

REV.

4

Optional Hand-Held Programmer

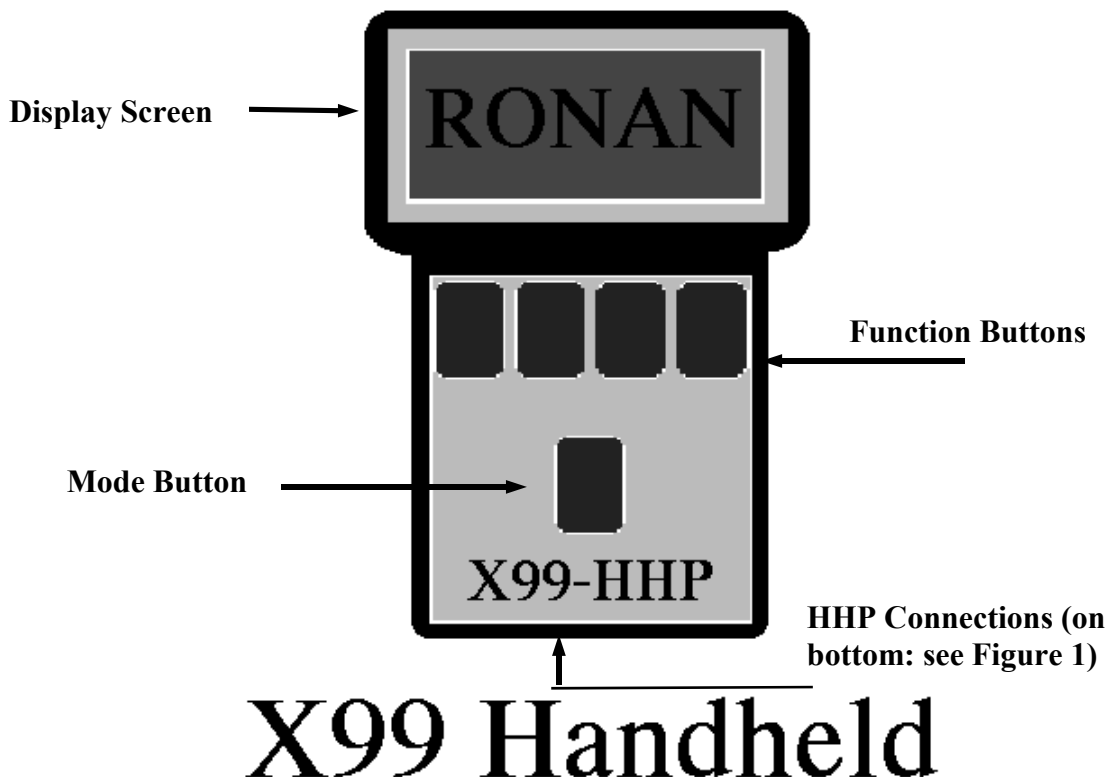
Connecting The H.H.P

Optional Hand-Held Programmer

Connecting with the HHP

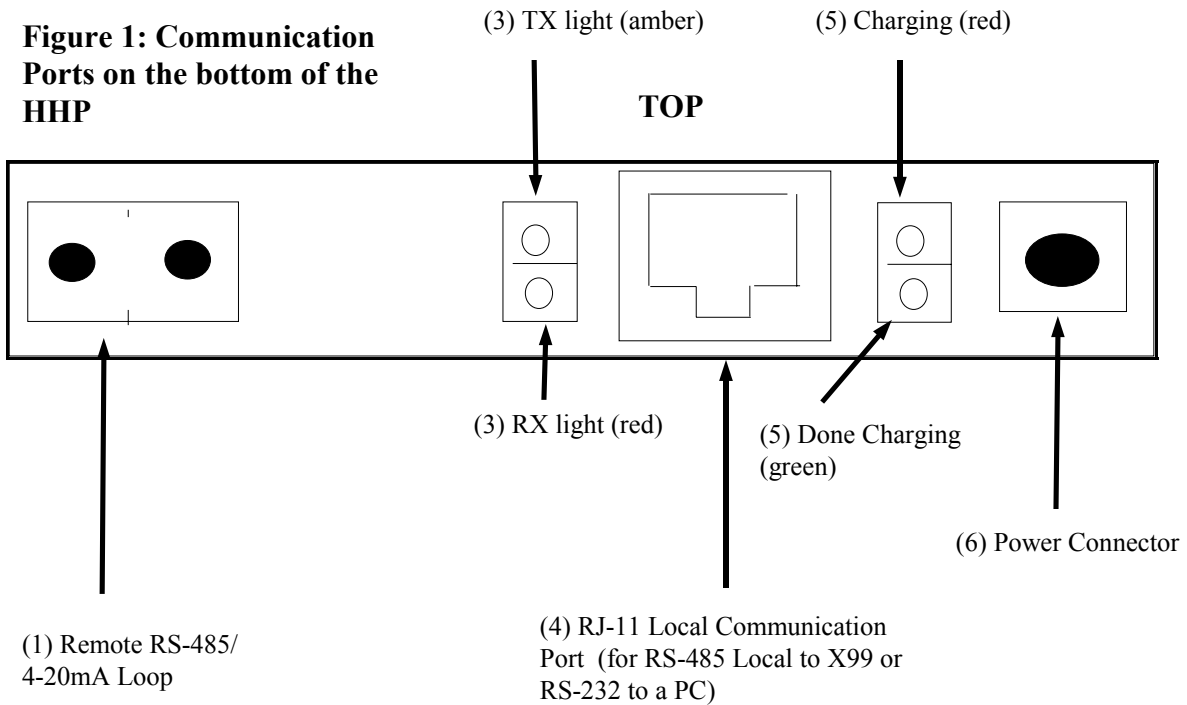
****NOTE****

The next two pages explain Operator Interfacing with the X99 Processor via the Hand-Held Programmer. It explains both communication along a RS-485 line and a 4-20 mA Loop.



The Hand-Held Programmer (HHP):

- 1) Display Screen: is a 4 x 20 LCD screen that displays the status of a given X99 Processor.
- 2) Function Buttons: These four buttons control the HHP. The Display Screen will display the commands that each button corresponds to (note: different screen displays will mean different command options).
- 3) Mode Button: Used for selecting a specific gage on a 'Daisy-Chained' RS-485 Loop. This button is also used for saving and retrieving the X99 Menu Variable data.
- 4) HHP Connections: These are the ports for transmitting and receiving information between the HHP and a X99 or PC.



Explanation of Different Communication Ports:

(1) Remote RS-485/ 4-20 mA Loop: The communication line between the X99 and the HHP via a RS-485 or a 4-20 mA loop connects at this port.

(2) The RS-485/ 4-20 mA switch decides the type of communication signal transmitted and received by the HHP. If the switch is to the left: the HHP is set up for RS-232 communications. If the switch is set to the right, the HHP is set for 4-20 mA communications.

(3) TX & RX lights: When lit, these lights indicate if the HHP is Transmitting information (TX) with an amber light or Receiving information (RX) with a red light.

(4) RJ-11 Communication Port: This port houses the local RS-485 and RS-232 connection. This port is used for local connection to the X99, or for local connection to a PC.

(5) Power lights: When lit, the top light (red) means that the HHP is charging the internal batteries (The battery option only applies when the 4-20 mA modem has been installed). This occurs when a power supply has been added to (6): Power Connector. When the HHP is done charging, the bottom light is lit green.

(6) Power Connector: This port houses the power supply. Connect the power supply into this port. (Caution: make sure the power supply is the proper type).

Calibration
Calibration
Calibration

Accessing the Menu Variables

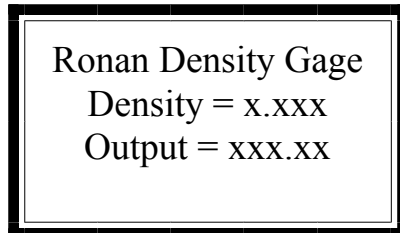


Figure 1a: Status Screen



Press any key (1-4) or button

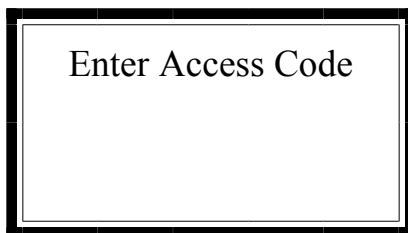


Figure 1b: Enter the Proper Access Code found in Chapter 2.7.

Box 1a: Steps to enter Menu Variables

1) Press any of the top keys under the Status Screen to obtain Figure 1.

2) Enter the proper access Code
1 2 1 3 2 3

When the PMP is first powered up (or if 'scan all devices is selected with the 'Mode' key), the PMP will scan the attached network for up to 32 devices. If any are found, select the desired X99 device by browsing the ID of those found. When one is selected, the Status Screen (or last display viewed) appears. The Status Screen is the default opening display screen that shows the given outputs of the X99 Density Gage.

The X99 has three programmable modes: the Status Line Editor, the Menu Variables, and the I/O Module Status. The Menu Variables are used to setup and calibrate the X99.

To access the Menu Variables, follow box 1a. The access codes are listed in Appendix C, chapter 8 page 9. If an invalid code is entered, a warning will appear. Press a key, and the screen's display is then returned to the Status Screen.

Menu Variables: Moving Between Groups and Variables

Menu Variable
Description
Value (if applicable)

Figure 2a: Description of the four lines of the Menu Variables.

Low Reference Group

Figure 2b: Example of a Group

The Menu Variables are listed in Appendix A, chapter 9. They are arranged in Groups (Bold-faced in Appendix A). The groups are organized by application and/ or functions.

Press OPEN to enter the Group's Variables. NEXT and PREVIOUS scroll from Group to Group. If a Group has been entered, scroll between the Menu Variables within that Group via the Next and Previous keys.

To Exit a Group, go to the last menu variable in that group and press NEXT.

Menu Variables: Modifying Variables

Changing a Menu Variable, an example:

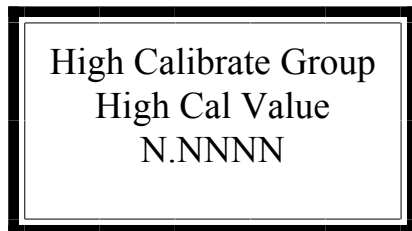
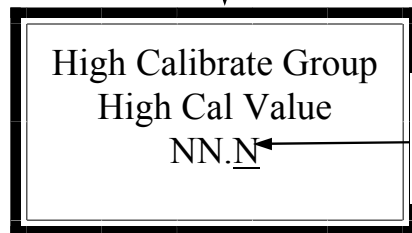


Figure 3a



Press “Mod” to change the value



Value to be changed

Figure 3b: Changing the Value

Press “Incr” and “Decr” to change the value. Press “Shft” to move the cursor. Press “Done” when

If a variable’s value needs to be changed, or modified, locate that Menu Variable. Press the MODify key to change the value (Figure 3a will go to Figure 3b).

Use the SHiFT key to move the cursor (underlined in Figure 3b) to the right (if more than one digit exists). INCRement increases the highlighted value by one, while DECRement decreases the value by one (Figure 3b).

Once the new value has been entered, press DONE and then either SAVE to save the modifications or QUIT to restore the original value of the variable. “Value out of range” will appear if an invalid value has been entered.

See Box 3a for an explanation of

Box 3a: Types of Variables:

- 1) Read-Only Variables: Variables that cannot be changed. These variables display a value that has been calculated by the X99 Processor.
- 2) True Values: variables that the entered values are the value of the variable (i.e. 189 means 189).
- 3) On/Off or Enable/Disable: Variables contain multiple choices. Pressing one of the ‘change’ keys will index through the choices.
- 4) Table Variables: These variables have the characters ‘Tbl’ in the title line. The value initially displayed is the first entry in the tables (index 1). Pressing the ‘Modify’ key here will allow you to index through the table entries and view or modify the values. Press the ‘Exit’ key to exit the Table Variables. Note: All entries in a Table Variable have the same Menu Variable Number.
- 5) Variables with the word ‘Get’ or ‘From’: are Menu Variables that obtain their values by calling the value of another Menu Variable.

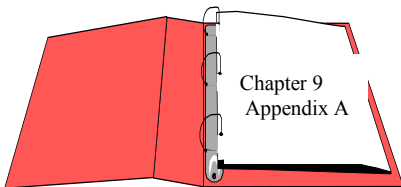
Calibrating the System This section gives a three step process to give the X99 Density Gage an initial calibration. The three steps are:

- 1 Check Factory defaulted Menu Variables so that they are appropriate for the given application. Make changes where necessary and document these changes.
- 2 Perform an Reference and Calibration that correlates the X99's output to the actual process density that is determined by laboratory sampling.
- 3 Documentation of changes in all factory-default settings. Keep this for future reference.

1 Factory-Default Settings

Locate the Menu Variables which are filed in Chapter 9 of this manual. That information will indicate how the system was configured for your application. Check the Menu Variables and change accordingly (especially the output groups).

Document all the changes. Keep this document in chapter 9 for future reference.



Reference: :
Menu Variables in Appendix A

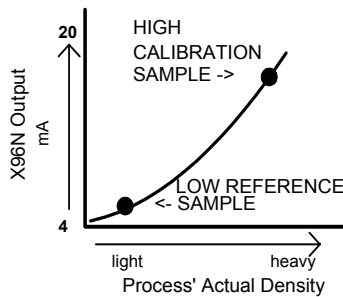
2 Calibration

Calibration correlates the X-99's output to the actual density of the process. It instructs the microprocessor to read and store the detector counts for a low and high density of process. Once the system is conditioned to recognize the low and high density, it will provide an output over the entire range of interest (such as a 4-20 mA output).

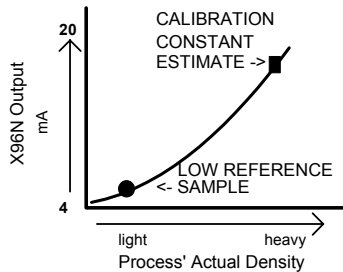
Preparation for Calibration

WHAT type of Calibration is needed?

Two types of Calibration are available for Ronan's Density Monitor.



Dual-Point Calibration requires an accurate laboratory analysis of truly representative samples of **two** process densities. Dual-Point Calibration is preferred when the process can be varied to obtain two process densities (one at each end of the measurement range).



Single-Point Calibration requires an accurate laboratory analysis of a truly representative sample of **one** process density. Single-Point Calibration is used as an alternative method when it is not physically or economically practical to vary the process density. In these cases, a second point is estimated based on the mathematical formula for radiation transmission/absorption, where the transmission constant is manually entered.

Sampling

**What type of process sample is needed?**

Any conveniently obtained process density that is within the range of interest can be used. For example, water-based slurries could use water as the reference sample. Sub-water slurries could use an empty pipe for the reference condition.

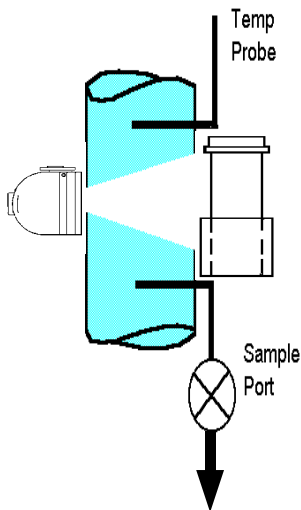
WHAT type of sampling procedure is needed?

The sampling procedure will depend upon the process. Do what is necessary to obtain a truly representative sample of the density(ies) to be calibrated. Pull a minimum of three samples of each density. (This means at least three samples of one density for single-point calibration, and at least three samples of two densities for dual-point calibration). Take necessary precautions to preserve the integrity of each sample.

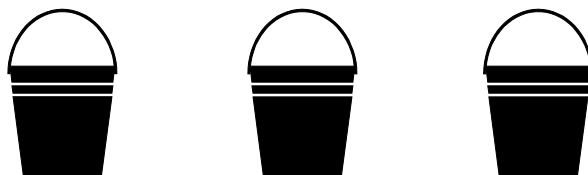
EQUIPMENT SHOULD BE RUNNING AT NORMAL ENVIRONMENTAL CONDITIONS - TEMPERATURE, PRESSURE, PROCESS FLOW, ETC.

WHAT type of laboratory analysis is required?

Precise laboratory analysis will produce the most accurate and useful results. If temperature or pressure compensation is used, see Chapter 8 for the steps to accurately analyze the process' density.



Final gage measurements can be only as accurate as the sampling and analysis technique.



Dual-Point Calibration

As the name suggests, the Dual-Point Calibration standardizes the gage against two known densities (a low and a high). First, **REFERENCE** the system at some known low density, and then, **CALIBRATE** the system at some higher density.

****NOTE****

Once the desired functions are configured, the Low Reference Function and the High Calibrate Function are the only functions needed (see steps 2, 3, 4, 5 and 6 for a basic calibration).



Low Reference Group

Figure 8a: Entering Low Ref Group

↓
Press



High Calibrate Group

Figure 8b: Entering High Calibrate Group

↓
Press

1) Enable the functions in the gage that are expected to be used. See Appendix A in chapter 9 and mark in the chart which functions need to be enabled. To enable these functions, go to the given Menu Variable, and select 'Enabled'.

2) Locate the Low Reference Group and press OPEN.

3) Execute a Low Reference with the pipe set up with the Low Reference Density. See next page for Low Reference instructions.

4) Locate the High Calibrate Group and press OPEN.

5) Execute a High Calibrate with the pipe set up with the High Calibrate Density. See page 10 for High Calibrate instructions.

6) Exit the Menu Variables (see pg. 13). The Status Screen should be displaying accurate values for its outputs.

Low Reference Group
Low Ref Fault Counts
000010

Low Ref. Fault Counts:

This is the count value that the detector signal must stay above during a Low Reference. It ensures that you do not accidentally perform a High Calibrate when the pipe is at Low Reference conditions.

High Calibrate Group
Hi Cal Fault Counts
020000

Hi Cal Fault Counts:

This is the count value that the detector signal must stay below when executing a High Calibrate. It ensures that you do not accidentally perform a Low Reference when the pipe is set up for the Calibrate condition.

Gage-Detector Group
Detector Low Flt Cts
000010

Detector Low Flt Cts:

If the Raw counts fall below this value, the Detector Fault Relay will be energized, an in-process Low Reference or High Calibrate will be aborted.

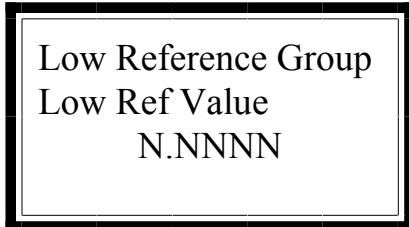
Gage-Detector Group
Detector Hi Flt Cts
020000

Detector Hi Flt Cts:

If the Raw Counts reach this level, the Detector Fault Relay will be energized, and an in-process Low Reference or High Calibrate will be aborted.

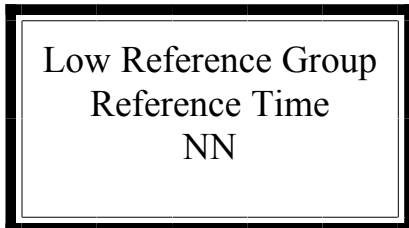
Performing a Low Reference:

**Make sure the Source is
Open for calibration!**



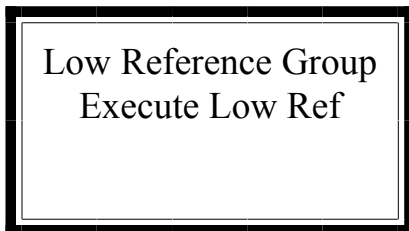
```
Low Reference Group
Low Ref Value
  N.NNNN
```

Figure 9a: The Low Referencing Value



```
Low Reference Group
Reference Time
  NN
```

Figure 9b: Time taken for Low Referencing



```
Low Reference Group
Execute Low Ref
```

Figure 9c: Executing Low Ref:
Make the value '1'.

1) Locate the Low Reference Group and enter into the Menu Variables for this group, by pressing OPEN.

2) Select the Low Reference Value Menu Variable, Figure 9a, and set the value to the Low Reference Density (1.0000 for water, 0.0000 for air). (see pages 1-3 on modifying Menu Variables).

3) Check the Reference Time, Figure 9b, for validity. The Reference Time is the time the system will spend executing a Low Reference (usually 2-60, defaulted at 20 seconds).

4) Locate the Execute Low Ref Menu Variable, Figure 9c, and press the MODify key, and follow the two remaining prompts.

Performing a High Calibrate:

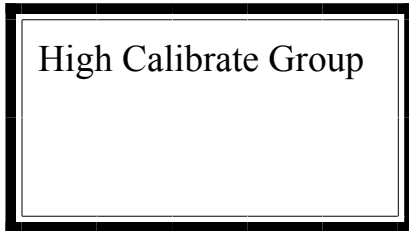


Figure 10a: Entering the High Calibrate Group

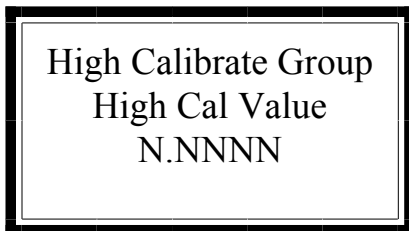
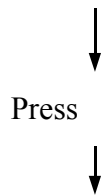


Figure 10b: Entering the High Calibration Value.

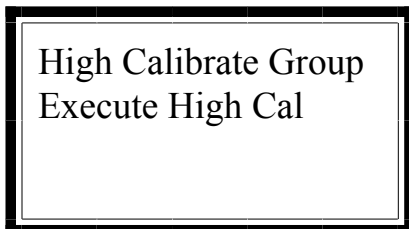


Figure 10c: Executing the High Calibration Variable.

1) Make sure the High Calibrate density is in the source path between the radioactive source and the detector.

2) Locate the High Calibrate Group and press OPEN to enter into the Group's variables, Figure 10a.

3) Select the High Calibrate Value Menu Variable, Figure 10b, and set the value to the desired High Calibrate Density. If the density is to be determined after the High Calibrate function (such as using a 'grab sample'), enter a value for this variable that is close to the expected value. After calibration, modification of this value can occur, and the X99 Processor will then recalculate the Transmission constant. This **cannot** be done in a Low Reference.

4) Locate the Execute High Cal Menu Variable, Figure 10c, and press the MODify key. Follow the two remaining prompts.

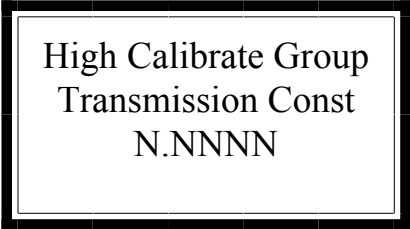
One-Point Calibration Procedure

(*) ALTERNATE 1/uT METHOD:

As an alternative, the single-point reference can be used. In that case, the results of the first sampling procedure are used in conjunction with a manually-calculated Transmission constant where:

$$\frac{1}{\mu T} = \text{Transmission Constant}$$

and μ = absorption coefficient (=0.2)
T = pipe's inner diameter (in inches)



High Calibrate Group
Transmission Const
N.NNNN

Figure 11a: Entering the Transmission Constant manually

Steps:

1) Follow the Auto-Setup steps on pages 7-8 of this chapter for steps 1-4. At step 5, do this:

5) Enter the High Calibrate Group by pressing OPEN. Locate the Transmission Constant Menu Variable, Figure 11a. Enter the calculated Transmission Constant. (see pages 1-3 for Menu Variable modifications).

Exiting Menu Variables



Figure 13a

To Exit the menu list,
1) Press the Exit button at any
Menu Variable.

Once at Figure 13a, press “Yes” to
exit. Press “No” to return to the
Menu Variables list.

The Status Screen will again be
displayed, with the given outputs
that correspond to the outputs
desired at time of order.

Quick Start

Procedures to Install, Reference and Calibrate the X99

Unpack the equipment and mount the equipment. See chapter 3 page 4 for details.

Wire the microprocessor and detector. See chapter 4 the last page for the interconnect diagram.

Connect the Hand-Held Programmer (HHP) to the microprocessor. See chapter 5 page 1-3 for details.

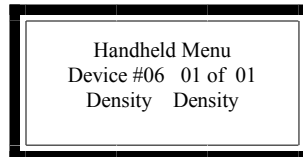
Turn the Power Switch to the ON position from the AC Power Supply Module. See chapter 4 page 4 for details.

Press the "MODE" key on the HHP to turn on the display.

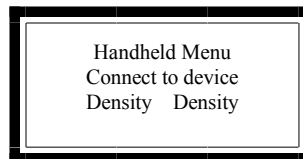
Press the "OK" key to "Scan for Devices".

Press the "OK" key to Devices found = 01.

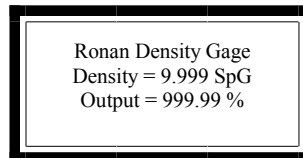
Press the "OK" key to



Press the "OK" key to "Connect to device"



This Screen is called the Status Screen



Press any of the top four keys on the HHP to exit the Status Screen and this will allow you access to the "Enter Access Code" screen..

Enter in the access code "1 2 1 3 2 3"

Now you can access the Menu Variables screens.



Make sure the Source is Open for calibration!

Performing a Low Reference:

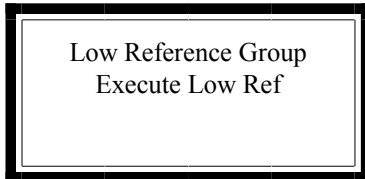


Figure 9a: Executing Low Ref:

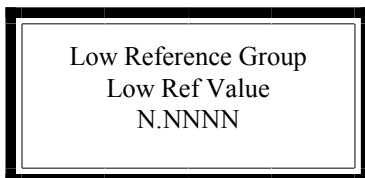


Figure 9b: The Low Referencing Value

1) Toggle the "Next" key until you reach the "Low Reference Group" Press the "Open" key

2) Toggle the "Next" key until you reach the "Auto Setup Enable" Menu. Press the MODify key. Disable this option.

3) Toggle the "Next" key until you reach the "Execute Low Ref" Menu, Figure 9a, and press the MODify key, and follow the two remaining prompts. (Continue, Save)

4) Toggle the "Prev" key until you reach "Low Reference Value" Menu, Figure 9b, and set the value to the desired Low Reference Value. (See Chapter 8 pages 1-3 on modifying Menu Variables).

4) Press the "Exit" key and return the Status screen.

Performing a High Calibrate:

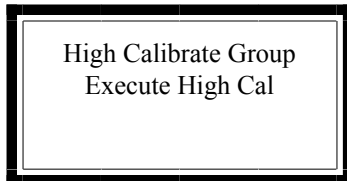


Figure 10a: Executing the High Calibration Variable.

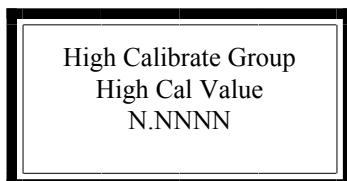


Figure 10b: Entering the High Calibration Value.

1) Toggle the "Next" key until you reach the "High Calibrate Group" Press the "Open" key

2) Toggle the "Next" key until you reach the "Execute High Cal" Menu, Figure 10a, and press the MODify key, and follow the two remaining prompts. (Continue, Save)

3) Toggle the "Prev" key until you reach "High Cal Value Value" Menu, Figure 10b, and set the value to the desired High Cal Value. (See pages 1-3 on modifying Menu Variables).

4) Press the "Exit" key and return the Status screen.

Make sure the Source is Open for calibration!

Pipe should be full and ready to do a Low Reference.

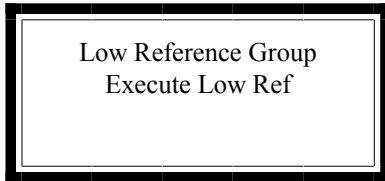
Performing a Low Reference:

Figure 9a: Executing Low Ref:

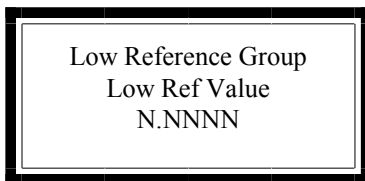


Figure 9b: The Low Referencing Value

1) Toggle the “Next” key until you reach the “Low Reference Group” Press the “Open” key

2) Toggle the “Next” key until you reach the “Auto Setup Enable” Menu. Press the MODify key. Disable this option.

3) Toggle the “Next” key until you reach the “Execute Low Ref” Menu, Figure 9a, and press the MODify key, and follow the two remaining prompts. (Continue, Save)

4) Toggle the “Prev” key until you reach “Low Reference Value” Menu, Figure 9b, and set the value to the desired Low Reference Value. (See pages 1-3 on modifying Menu Variables).

Performing a High Calibrate:**(*) ALTERNATE**

As an alternative to a High Calibrate, the Transmission constant can be manually calculated and keyed in.

Transmission Constant = $1 / \mu T$
 and μ = absorption coefficient (=0.2)
 T = pipe’s inner diameter (in inches)

Example

4 inch pipe id
 Transmission Constant = $1 / (0.2 \times 4) = 1.25$

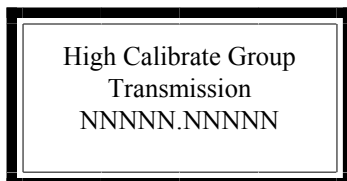


Figure 11a: Entering the Transmission Constant manually

1) Toggle the “Next” key until you reach the “High Calibrate Group” Press the “Open” key

2) Toggle the “Next” key until you reach the “Transmission Constant” Menu. Press the MODify key. Set the value to the correct value. (See pages 1-3 on modifying Menu Variables).

3) Press the “Exit” key and return the Status screen.

Analog Output
Module
Set-Up Procedure

Analog Output Module Setup Procedure

Equipment



Volt/Amp Meter

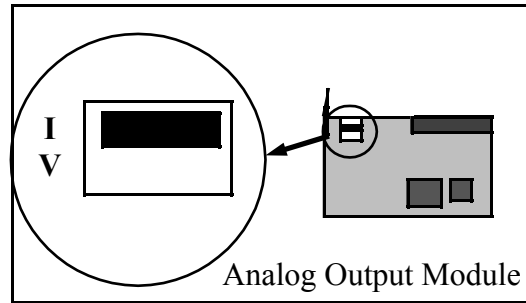


X99 Handheld

Required:



X99 Transmitter



Analog Output Module

Before you start, determine whether you are using the Analog Output module as a voltage(V) or current (I) output, and set the switch on the Analog Output module to reflect your choice. The above is shown in the current position.

Access the Analog Output module's Setup function through the gage's I/O Status Menu, and press the 'Next' key (displays the Zero Out Signal frame).

Setup the Zero Signal

This is the minimum output signal this module will produce.

- 1) Press the Modify Key to setup the Zero Signal (displays the Connect Zero Output frame).
- 2) Connect a DC voltage or current meter (depending on the switch selection from above) to pins 5 (positive) and 6 (negative) of the Analog Output module.
- 3) Modify the value on the display up or down (Incr or Decr) until the correct Zero Out value is displayed by your meter.
- 4) When the reading is correct, press the 'Done' key, then the 'Save' key to set the Zero value, or 'Quit' to abandon the setting. Either key returns you to the Zero Output Signal frame.

Setup the Zero Out Units

This value will be displayed as part of the 'module type' in the I/O Status frames.

- 1) Press the 'Next' or 'Prev' key until the Zero Out Represents frame is displayed.
- 2) If the Zero value you set up does not match this displayed value, press the 'Modify' key to change it. The value displayed here is for identification only. It is not used by the system.
- 3) Use the 'Shft', 'Incr', and 'Decr' keys to set the Zero value (00 Volts, 04 mA, etc.). Press 'Done' then either 'Save' to store the value, or 'Quit' to abandon the value.

Setup the Span Signal

This is the maximum output signal this module will produce.

- 1) Press the 'Next' or 'Prev' key until the Span Output Signal frame is displayed.
- 2) Press the Modify Key to setup the Span Signal (displays the Connect Span Output frame).
- 3) Connect a DC voltage or current meter (depending on the switch selection from above) to pins 5 (positive) and 6 (negative) of the Analog Output module.
- 4) Modify the value on the display up or down (Incr or Decr) until the correct Span Out value is displayed by your meter.
- 5) When the displayed value settles, press the 'Done' key, then the 'Save' key to set the Span value, or 'Quit' to abandon the setting. Either key returns you to the Span Output Signal frame.

Setup the Span Out Units

This value will be displayed as part of the 'module type' in the I/O Status frames.

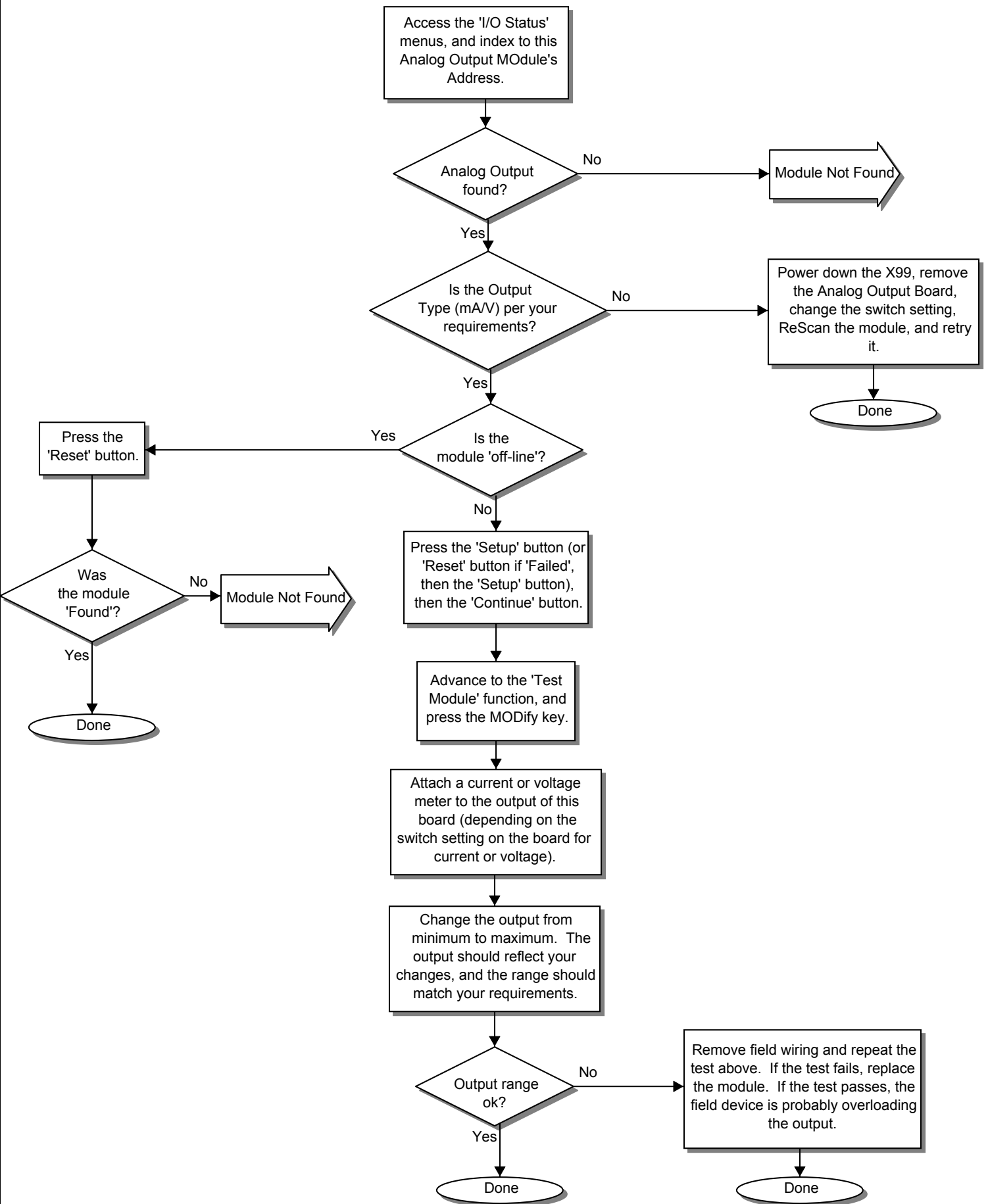
- 1) Press the 'Next' or 'Prev' key until the Span Out Represents frame is displayed.
- 2) If the Span value you set up does not match the displayed value, press the 'Modify' key to change it. The value displayed here is for identification only. It is not used by the system.
- 3) Use the 'Shft', 'Incr', and 'Decr' keys to set the Span value (10 Volts, 20 mA, etc.). Press 'Done' then either 'Save' to store the value, or 'Quit' to abandon the value.

Troubleshooting

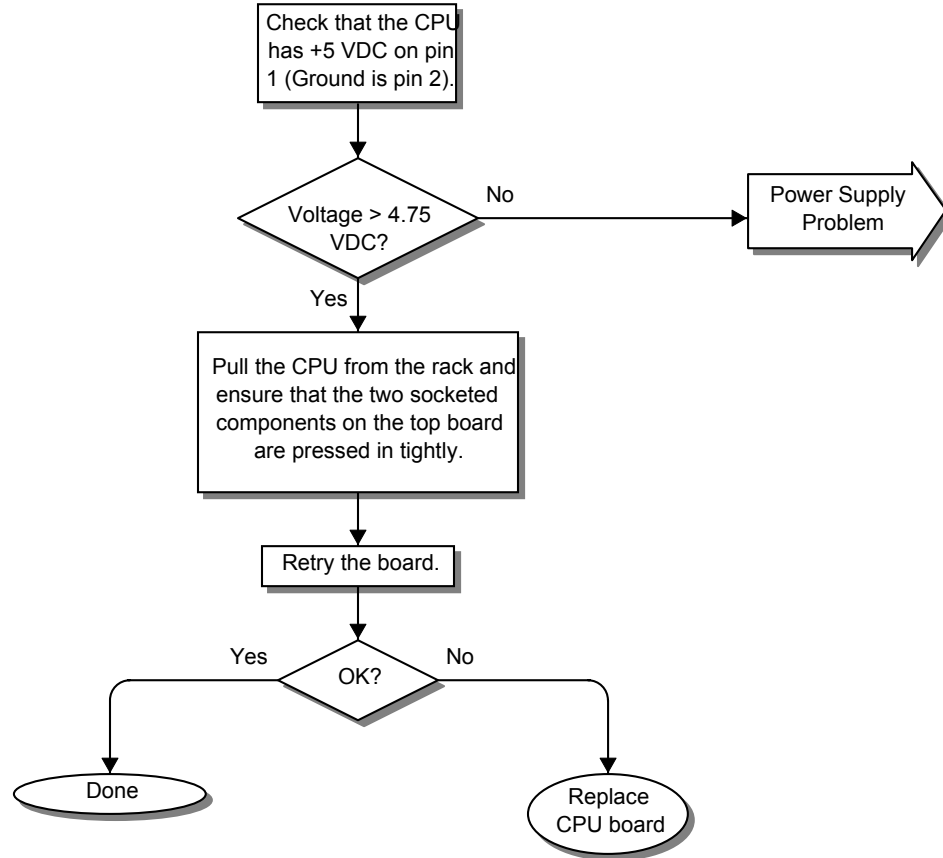
Troubleshooting

Troubleshooting

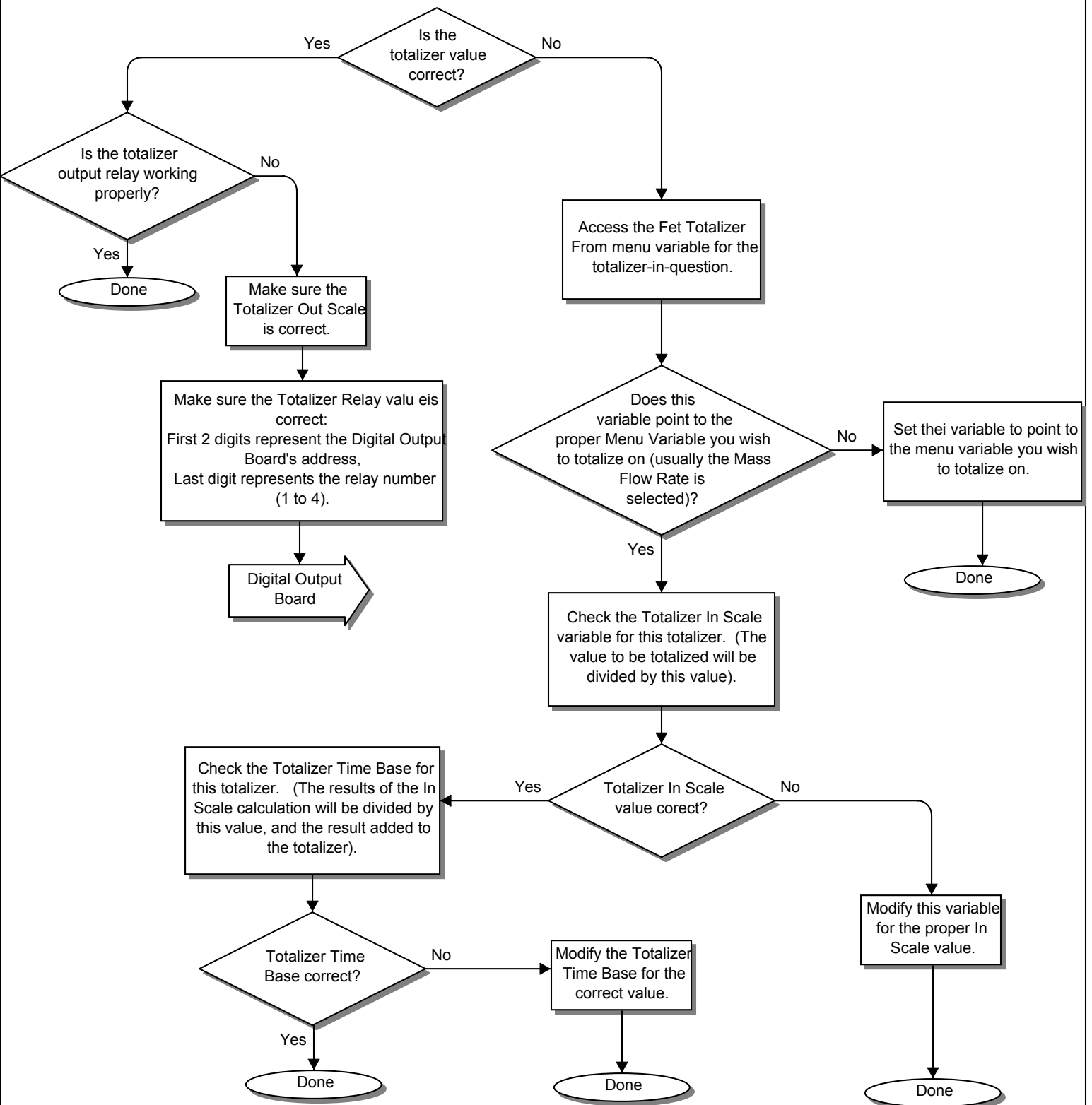
Analog Output Board



CPU Problem

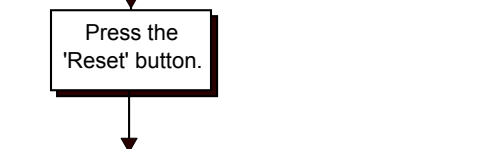
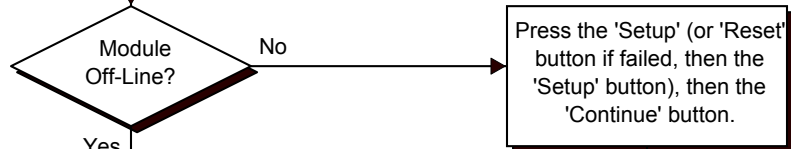
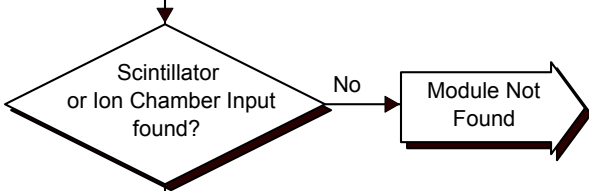


Totalizers Problem

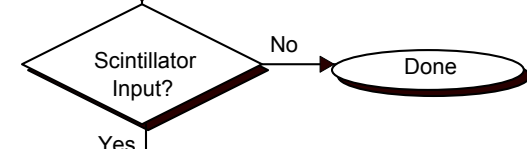


Detector Input Board

Access the I/O Status Menus and display address # 01.

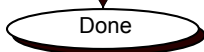


Press the 'Setup' (or 'Reset' button if failed, then the 'Setup' button), then the 'Continue' button.



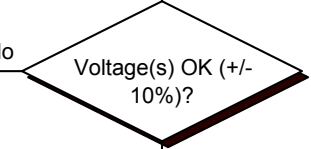
'Count Period' and ensure its value matches your scan rate (usually 400 mS).

Advance to the 'Prescale Divider' and ensure its value is set to 1.

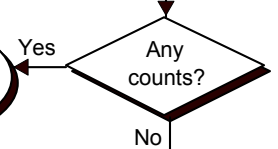


At the X99, identify the Detector Input Board in the rack.

For Scintillator Input: Check for +15 VDC at pins 6 & 7;
For Ion Chamber Input: Check for + 15 VDC on pins 9 & 6 and - 15 VDC on pins 10 & 6.

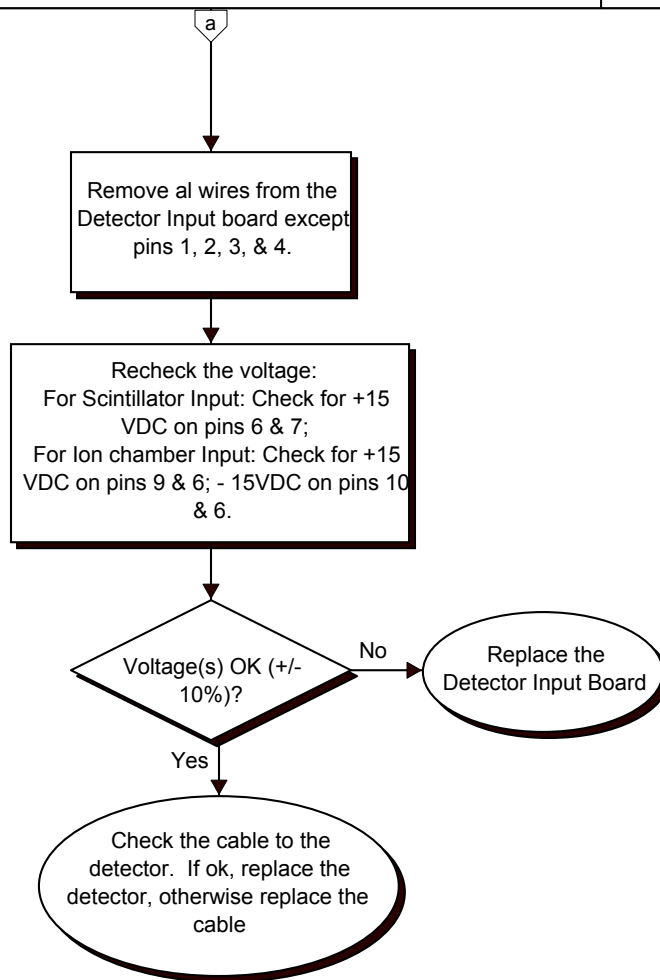


Check the input on pin 5 with: a counter (Scintillator) or vltmeter (Ion chamber).

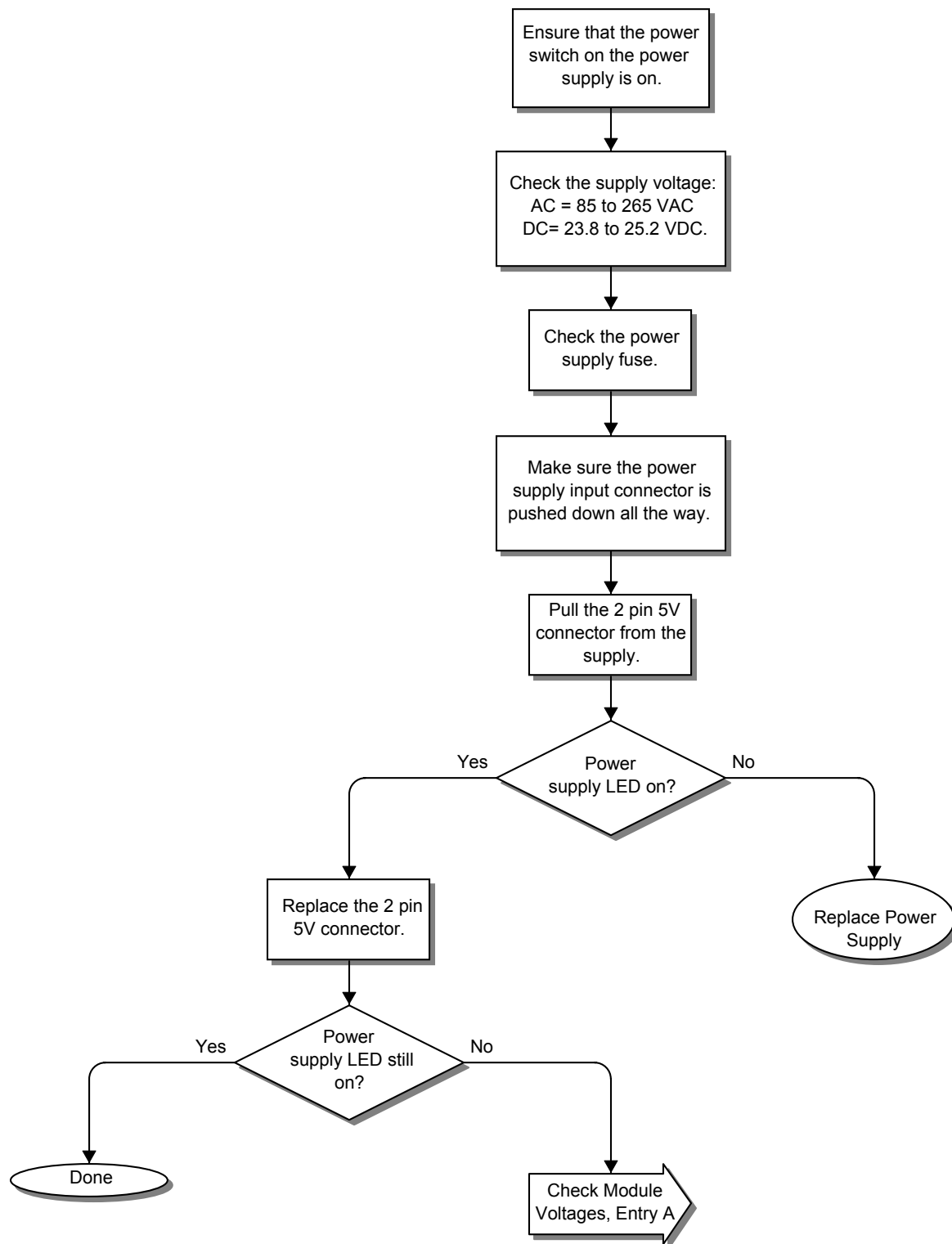


Check the cable to the detector. If ok, replace the detector, otherwise replace the cable.

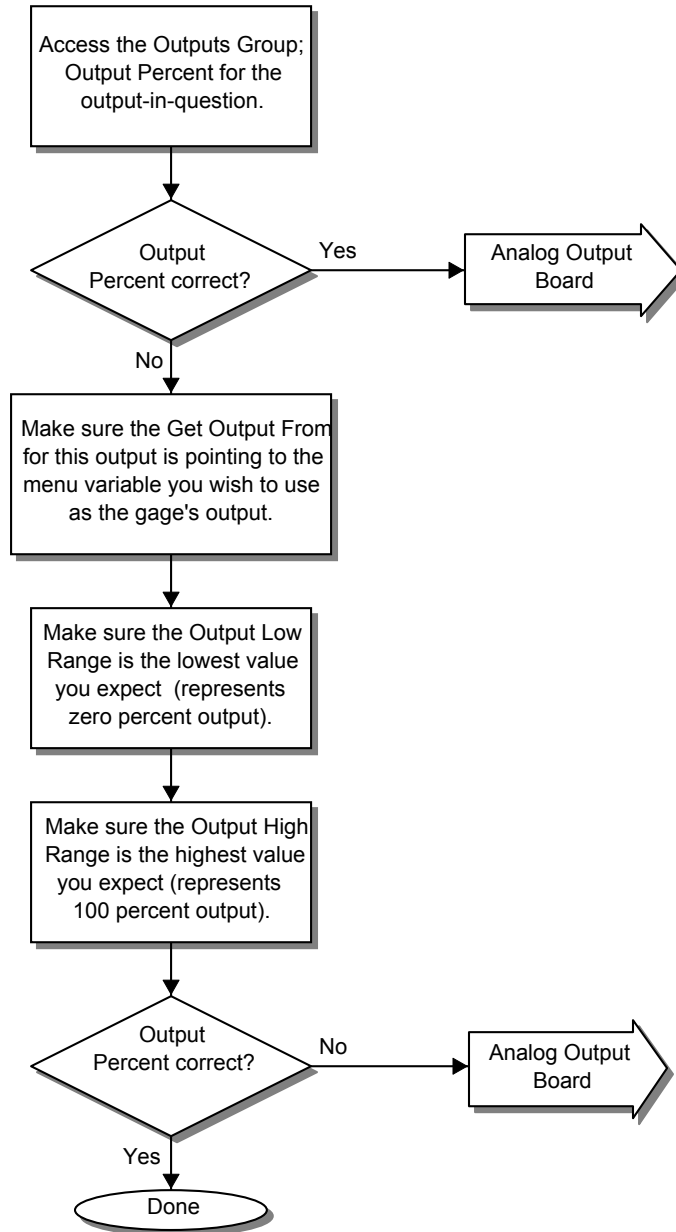
a



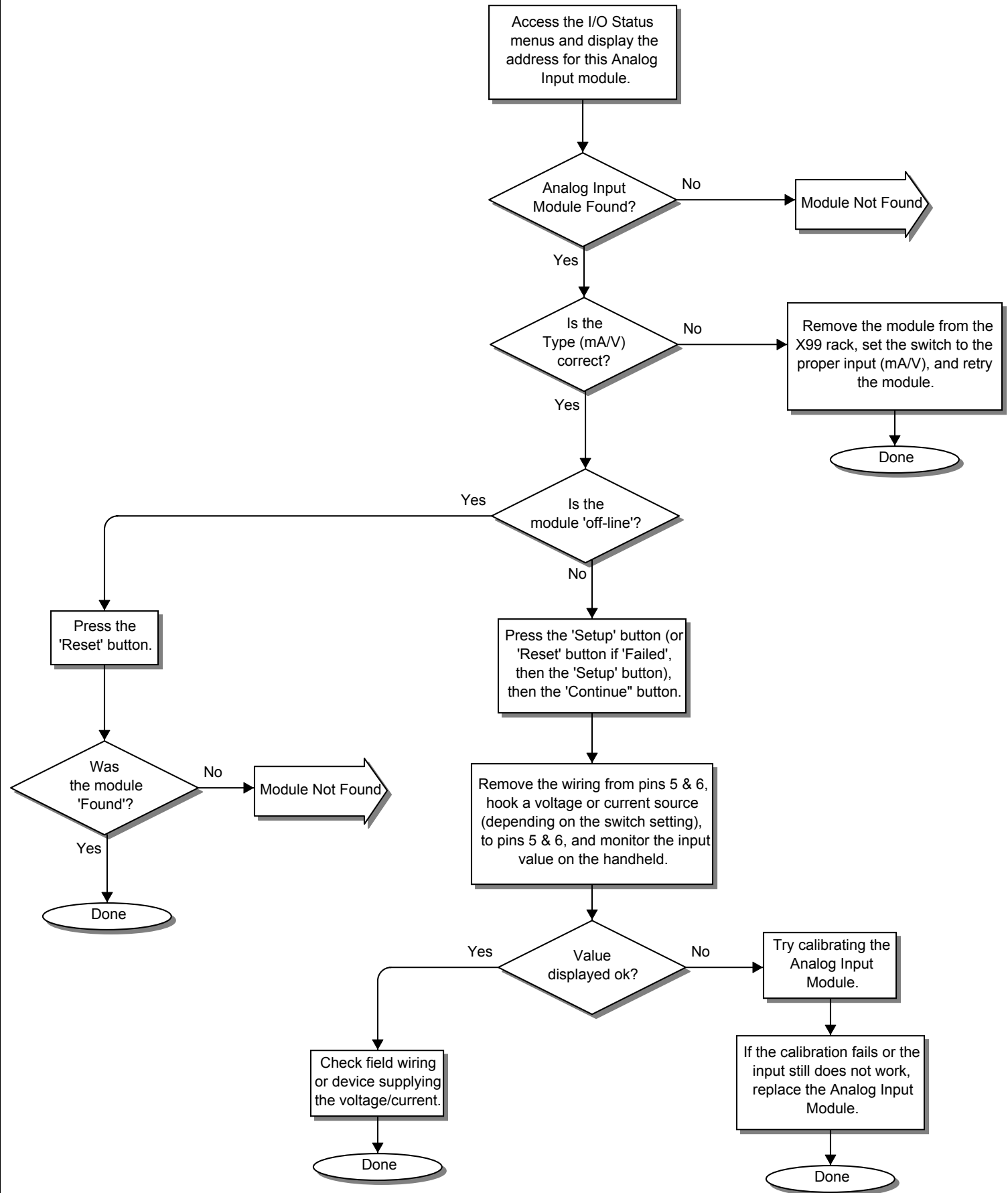
Power Supply Problem



Output Problem



Analog Input Board



Appendix

Appendix

Appendix

Appendix C: System Access Codes

The system access codes were intentionally inserted into an appendix in order to protect those wishing to use the custom passwords. It is advised to set up the custom passwords, issue them to individual users, and then remove this page from the manual. The standard access codes are not listed anywhere else in the manual. This way, the owner will have 'master' access using the standard access codes listed below, but the individual users will only know their 'custom' password. Assuming access to the 'Password Access' Menu Variables has not been granted, the system's changeable Menu Variables are protected from unauthorized access.

When the system is displaying the Status screen, press one of the top 4 keys on the handheld device, and enter one of the following codes for access:

Menu Variable Access Code: 1, 2, 1, 3, 2, 3

I/O Status Access Code: 1, 3, 1, 2, 3, 2

Status Line Editor: 1, 2, 2, 2, 2, 3

Custom Password 1: → → → → → →

Custom Password 2: → → → → → →

Custom Password 3: → → → → → →

NOTE: If usage of any user-defined (or custom) passwords in the system has been granted, record the passwords beside the Custom Passwords above for safekeeping.

Appendix D: Order of Characters shown in the Status Line Editor

When Modifying an alpha-numeric variable, 97 characters may be inputted. The following gives an order to the characters, so that the user can more easily input the desired characters.

```
[space] ! " # $ % & ' ( ) * + , . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ -
' a b c d e f g h i j k l m n o p q r s t u v w x y z { | } ~ □
```

Appendix E: Binary Address Calling of Modules and Gages.

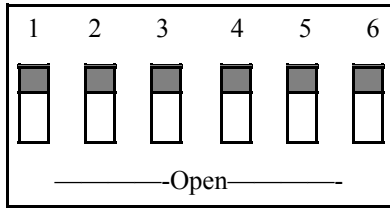


Figure 11a: Switch on CPU Board

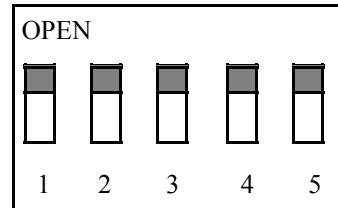


Figure 11b: Switch on Modules

When multiple gages are hooked up (daisy-chained), then the HHP needs to be able to identify each X99 Gage. This is done through binary addresses. Notice on the CPU module that there is a six switch orange box on the side, like in Figure 11a. The first five switches represent a binary address from 0-31. Each gage that is daisy-chained together must have a unique address. The sixth switch on the CPU is not used.

Each Module in an X99 has a unique address. This address is how the CPU talks to the Module, and how the HHP or PC talks to the Module in I/O Status. The gage software decides how many and which types of I/O modules are acceptable for that gage. The list of addresses are shown in Appendix B for each Module.

Below is a chart explaining the call numbers that are represented by the binary switches. Note: 0=Closed and 1=Open on the chart.

Address	Switches (1-5)	Address	Switches (1-5)	Address	Switches (1-5)
0	00000	11	11010	22	01101
1	10000	12	00110	23	11101
2	01000	13	10110	24	00011
3	11000	14	01110	25	10011
4	00100	15	11110	26	01011
5	10100	16	00001	27	11011
6	01100	17	10001	28	00111
7	11100	18	01001	29	10111
8	00010	19	11001	30	01111
9	10010	20	00101	31	11111
10	01010	21	10101		