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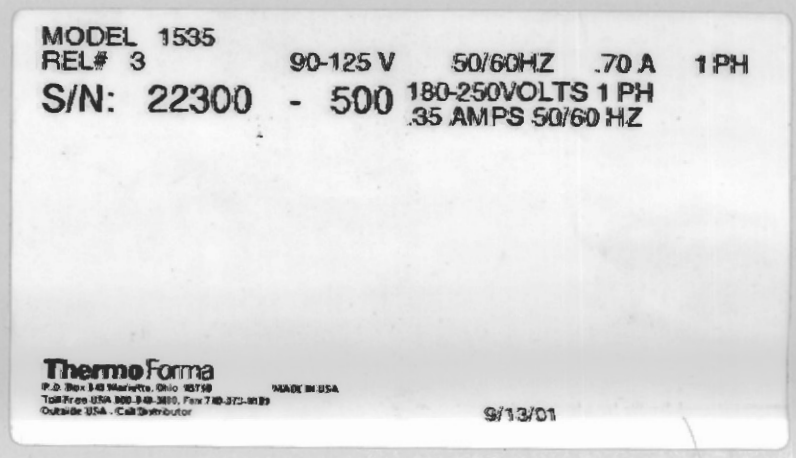
ThermoForma

Model 1535

24 Channel Monitor/Alarm System

Operating and Maintenance Manual

Manual No: 7021535 Rev. 5



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Read This Instruction Manual.

Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance.

CAUTION! All internal adjustments and maintenance must be performed by qualified service personnel.

Refer to the serial tag on the back of this manual.

The material in this manual is for information purposes only. The contents and the product it describes are subject to change without notice. Thermo Forma makes no representations or warranties with respect to this manual. In no event shall Thermo Forma be held liable for any damages, direct or incidental, arising out of or related to the use of this manual.

The Thermo Forma Model 1535 Monitor/Alarm is a Pollution Degree 2, Installation Category II (Overvoltage Category) device.

CAUTION
Contains Parts and Assemblies Susceptible to Damage by Electrostatic Discharge (ESD)

MANUAL NUMBER 7021535

REV	ECR/ECN	DATE	DESCRIPTION	By
5	--	8/21/00	Quark format	ccs
4	18871/AS-084	4/3/00	Added clock accuracy to Sections 2.6 and 9	ccs
3	SI-7602	3/7/00	Updated 190458-70 drawing	ccs

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Important operating and/or maintenance instructions. Read the accompanying text carefully.

Ce symbole attire l'attention de l'utilisateur sur des instructions importantes de fonctionnement et/ou d'entretien. Il peut être utilisé seul ou avec d'autres symboles de sécurité. Lire attentivement le texte d'accompagnement.

Wichtige Betriebs- und/oder Wartungshinweise. Lesen Sie den nachfolgenden Text sorgfältig.

Importante instruccions de operacion y/o mantenimiento. Lea el texto acompanante cuidadosamente.



Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.

Ce symbole attire l'attention de l'utilisateur sur des risques électriques potentiels. Seules des personnes qualifiées doivent appliquer les instructions et les procédures associées à ce symbole.

Gefahr von Stromschlägen. Nur qualifizierte Personen sollten die Tätigkeiten ausführen, die mit diesem Symbol bezeichnet sind.

Potencial de riesgos electricos. Solo personas das capacitadadas deben ejecutar los procedimientos asociadas con este simbulo.



Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.

Risques potentiels liés à l'énergie. L'équipement en entretien ou en maintenance doit être éteint et mis sous clé pour éviter des blessures possibles.

Geräte, an denen Wartungs- oder Servicearbeiten durchgeführt werden, müssen abgeschaltet und abgeschlossen werden, um Verletzungen zu vermeiden.

El equipo recibiendo servicio o mantenimiento debe ser apagado y segurado para prevenir danos.

- √ Always use the proper protective equipment (clothing, gloves, goggles, etc.)
- √ Always dissipate extreme cold or heat and wear protective clothing.
- √ Always follow good hygiene practices.
- √ Each individual is responsible for his or her own safety.

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Section 1 - Receiving

1.1 Preliminary Inspection

This item was thoroughly inspected and carefully packed prior to shipment and all necessary precautions were taken to ensure safe arrival. Immediately upon receipt, before the unit is moved from the receiving area, carefully examine the shipment for loss or damage. Unpack the shipment and inspect both interior and exterior for any in-transit damage.

1.2 Visible Loss or Damage

If any loss or damage is discovered, note any discrepancies on the delivery receipt and call the delivering carrier and request that their representative perform an inspection. Do not discard any of the packing material and do not move the shipment from the receiving area.

1.3 Responsibility for Shipping Damage

For products shipped F.O.B. Marietta, Ohio, the responsibility of Thermo Forma ends when the merchandise is loaded onto the carrier's vehicle.

On F.O.B. Destination shipments, Thermo Forma and the carrier's responsibility ends when your Receiving Department personnel sign a free and clear delivery receipt.

Whenever possible, Thermo Forma will assist in settling claims for loss or in-transit damage.

1.4 Packing List

The Model 1535 Alarm Monitor is shipped with the following materials:

Stock #	Qty.	Description
29760	2	Adding machine tape, 2-1/4" wide for printer
190468	1	5"x8" magnetic wipe-off sheet
297285	1	Black erasable pen
370342	1	4-position plug terminal block
370343	3	3-position plug terminal block
435050	1	Pocket screwdriver, flat blade
197068	2	Cable terminator
--------	1	Electrical Cord Set (country specific)
111029	1	Kwik Klip .375 PSA

Section 2 - Getting Started

2.1 Set-up and Installation Sequence for the Model 1535 Monitor/Alarm System

To simplify the installation and programming for the 1535 Monitor/Alarm System, follow these basic steps.

1. Read and understand the overview of the 1535 system as described in Section 2.2.
2. Create a floor plan that outlines the 1535 Installation - see Section 2.3.
3. Connect electrical power to the 1535 - see Section 2.4
4. Learn the basics of operating the control panel - see Section 2.5
5. Set the Date and Time on the 1535 - see Section 2.6.
6. Assign addresses to all the modules to be used with the 1535 system - see Section 2.7.
7. Connect interface modules to the laboratory equipment to be monitored - see Section 3.
8. Wire interface modules together using 4-wire cable and connect them to the 1535 - see Section 4.
9. Power the 1535 ON.
   - Allow the 1535 to scan the connected modules for 5 minutes.
   - Check the 1535 printout for RS-485 communication errors. See 7.2H and 7.2I for details about RS-485 communication errors.
   - If an error exists, power the 1535 OFF and check the wiring to the module in error. Repeat this step until no RS-485 errors exist.
10. Program the interface module data fields (a-f) as described in Section 5. This includes calibration, configuring the alarm conditions, and labeling the data fields. The default setting for the Alarms on each data field is OFF - make sure that the Alarm function is turned ON after the HI/LOW alarm limits have been programmed for each data field as described in Section 5.4.
11. Program the Print Interval for the 1535 - see Section 6.4.
12. Print and verify all the 1535 settings as described in Section 6.2. Print all the 1535 system parameters and the module parameters for each module connected to the system.
13. Simulate an alarm condition on each piece of laboratory equipment being monitored by opening the door; disconnecting alarm contacts, etc. and monitor the system for normal operation - see Section 7.

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2.2 The Model 1535 Monitor/Alarm System

The Model 1535 is a microprocessor-based monitor/alarm system that monitors and records data from 24 modules. (Figure 2-1) Each module is capable of sending as many as six fields of data for the 1535 to monitor which includes temperature, %CO2, %O2, relative humidity and contact closures.

A built-in dot matrix printer creates a permanent record of installation and operating data from the modules and the 1535. Alarm conditions are printed in red on the paper tape along with the time and date they occurred.

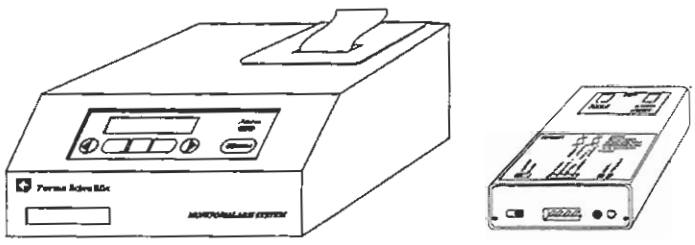


Figure 2-1
The Forma Model 1535 Monitor/Alarm and Interface Module

An RS-485 communications format is used to send data from each of the modules back to the 1535. RS-485 communications are particularly well suited for use in industrial environments over long distance which allows the modules to be located a maximum of 2000 feet from the 1535 Monitor/Alarm as illustrated in Figure 2-2.

The purpose of the modules is to convert the output signals from laboratory equipment to the RS-485 format used to communicate with the 1535. Modules are available to convert 0-1 V analog signals and RS-232 signals to the RS-485 format.

The RS-232 module is compatible only with the RS-232 format available on Thermo Forma laboratory equipment. In addition, a module is available with its own temperature probe (4-wire RTD) that can be used as an independent temperature monitor for laboratory equipment not providing suitable output signals.

The modules are connected to the 1535 using a 4-wire cable consisting of two twisted pairs of wires; one pair for power and ground and the other pair for RS-485 transmissions. The cable is recommend to be routed from module to module in a "daisy chain" to maintain optimal performance at a distance of 2000 feet. An optional UPS (Uninterruptable Power Supply) is available to power the system during an electrical outage.

The modules are given a unique address, or channel, that the 1535 uses when requesting data from each module. Using the control panel and LCD display on the 1535, the system can be programmed to set high and low alarm limits, alarm delays and other parameters for each signal received from a module. This allows the system to be customized to meet a wide range of research requirements.

In addition, an optional 1.44 MB floppy disk drive is available to store data, alarm conditions and programming set ups. The 1535 system can also be connected to an existing alarm system or telephone dialing system through three sets of alarm contacts on the back of the unit.

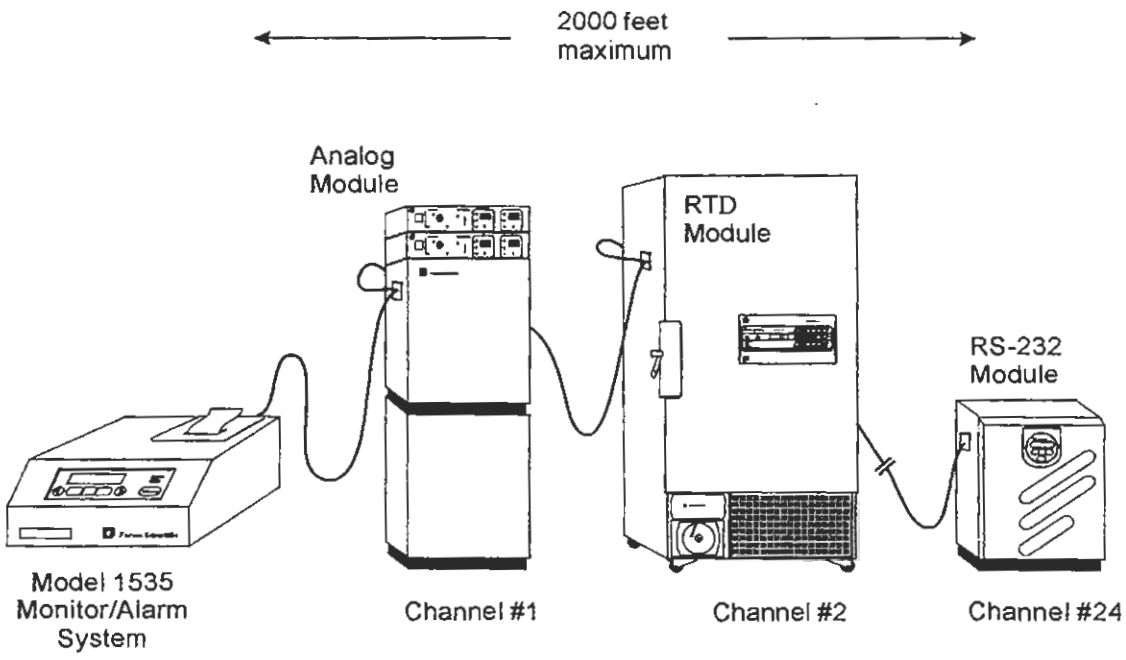


Figure 2-2 Connecting Alarm Interface Modules (Daisy Chain)

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2.3 Creating a Floor Plan

Prior to installing the 1535 Monitor/Alarm system, a floor plan should be drawn, showing the locations of the equipment to be monitored. From this plan, a list can be generated which will aid in programming alarm limits, alarm delays, and other variables. It will also serve as a system wiring diagram. A sample floor plan and list are shown in Table 2-1 and Figure 2-3.

Type of Equipment	Remote Module	Chnl# (1-24)	Field (a-f)	Data
Shaker 4518	N/A*	1	a	time
"		1	b	speed
"	"	1	c	alarms
"	"	1	d	temp
8400 Freezer	RS-232	2	a	temp
"	Stk# 190458	2	e	contacts
8400 Freezer	RS-232	3	a	temp
"	Stk# 190458	3	e	contacts
Refrigerator	RTD	4	a	temp
"	Stk# 190457	4	b	contacts
8400 Freezer	RS-232	5	a	temp
"	Stk# 190458	5	f	contacts
Refrigerator	RTD	6	a	temp
"	Stk# 190457	6	b	contacts
Refrigerator	RTD	7	a	temp
"	Stk# 190457	7	b	contacts
Refrigerator	RTD	8	a	temp
"	Stk# 190457	8	b	contacts
3326 W/J	Analog	9	a	temp
Top	Stk# 190459	9	b	CO2
"	"	9	e	contacts
Bottom	"	9	c	temp
"	"	9	d	CO2
"	"	9	f	contacts
3193 W/J	RS-232	10	a	temp
"	Stk# 190458	10	b	CO2
"	"	10	e	contacts
Refrigerator	RTD	11	a	temp
"	Stk# 190457	11	b	contacts
Shaker 4518	N/A*	12	a	time
"	"	12	b	speed
"	"	12	c	alarms
"	"	12	d	temp
Refrigerator	RTD	13	a	temp
"	Stk# 190457	13	b	contacts
Refrigerator	RTD	14	a	temp
"	Stk# 190457	14	b	contacts
Refrigerator	RTD	15	a	temp
"	Stk# 190457	15	b	contacts
900 Freezer	RTD	16	a	temp
"	Stk# 190457	16	b	contacts
Refrigerator	RTD	13	a	temp
"	Stk# 190457	13	b	contacts
Refrigerator	RTD	14	a	temp
"	Stk# 190457	14	b	contacts
Refrigerator	RTD	15	a	temp
"	Stk# 190457	15	b	contacts
900 Freezer	RTD	16	a	temp
"	Stk# 190457	16	b	contacts
900 Freezer	RTD	17	a	temp
"	Stk# 190457	17	b	contacts
8500 Freezer	RS-232	18	a	temp
"	Stk# 190458	18	e	contacts
8500 Freezer	RS-232	19	a	temp
"	Stk# 190458	19	e	contacts
LN2 storage	RTD	20	a	temp
"	Stk# 190456			
LN2 storage	RTD	21	a	temp
"	Stk# 190456			
LN2 storage	RTD	22	a	temp
"	Stk# 190456			
Room	RTD	23	a	temp
	Stk# 190457			
Envir. Room	RTD	24	a	temp
"	Stk# 190457			

* Channel # for Shakers needs to be allocated under the "ADD MODULE" MENU ON THE 1535 (See Section 6). Remote modules are not used with Thermo Forma Orbital Shakers equipped with the RS-485 option. See Section 3.6 for cable part number.

Table 2-1
Typical Alarm Programming List

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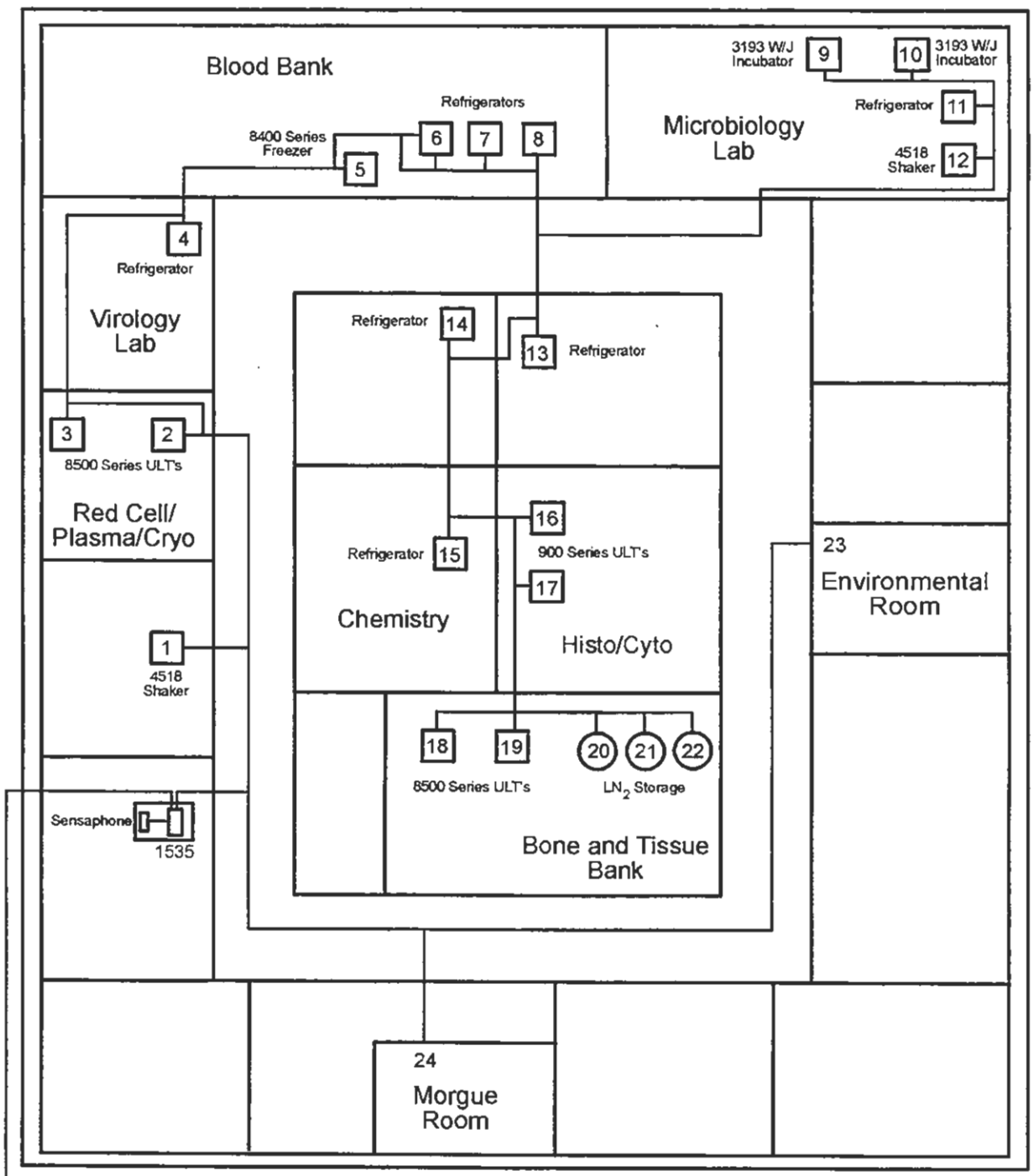


Figure 2-3
Typical Installation Floor Plan

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2.4 Connecting Electrical Power

The electrical power requirements of the Monitor/Alarm are:

Model 1535 90-125 VAC, 50/60 Hz, 1 PH, 0.7 FLA
180-250 VAC, 50/60 Hz, 1 PH, 0.35 FLA



This unit must be connected to a grounded electrical circuit. Do not operate this system with the grounding conductor disconnected.

Because Thermo Forma products operate at a wide range of voltages, the electrical line cord is not permanently wired to the unit. Instead, a line cord receptacle is provided which accepts power cords for 110 volts or 220 volts. A line power selector and fuse holder is located behind a cover on the rear panel of the Monitor/Alarm above the power switch.

This selector-fuse holder must be set for the voltage in use at the laboratory site. Figure 2-4 shows the location of the line power selector, power switch and line cord receptacle. Refer to Section 8.5 to change the voltage setting.



Before plugging in the Monitor/Alarm, verify that the appropriate line voltage appears in the window on the fuseholder. Refer to Figure 2-4 for the location of the line power selector.

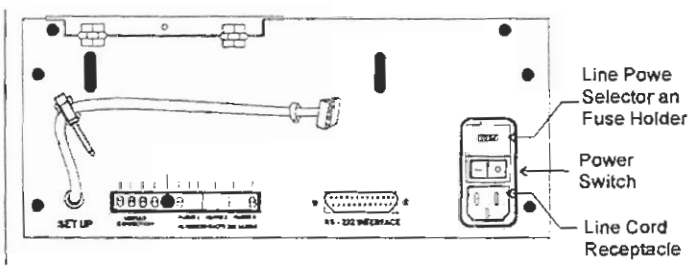


Figure 2-4
Rear Panel of the Monitor/Alarm Cabinet

2.5 Operating the Control Panel

The Model 1535 Monitor/Alarm System control panel uses micro-switch push buttons which respond with a tactile "click" when pressed. A "beep" is also sounded when the unit receives the button press.

The Liquid Crystal Display (LCD) shows the information being entered into the system and directs the operator through the programming and monitoring sequences. Figure 2-5 illustrates the control panel and identifies its elements.

The Model 1535 Control Panel has six operating keys or push buttons. The Alarm Silence button is marked and the Left and Right arrow buttons are identified by their symbols. An alarm warning indictor is located above the Silence button.

Note: The left arrow always returns the display to the previous screen without modifying any parameters. The right arrow scrolls the display to a new screen if one is available. The Alarm Silence key silences the audible tone for all alarms.

The functions of the three unmarked buttons below the LCD vary with the particular menu screen and the information being entered into the system. As information is entered or the operating programs modified, the functions of the buttons change. Their new functions are then identified on the portion of the LCD above the button.

Figures 2-6 and 2-7 illustrate the three information entry buttons and how they are identified by the menu screens.

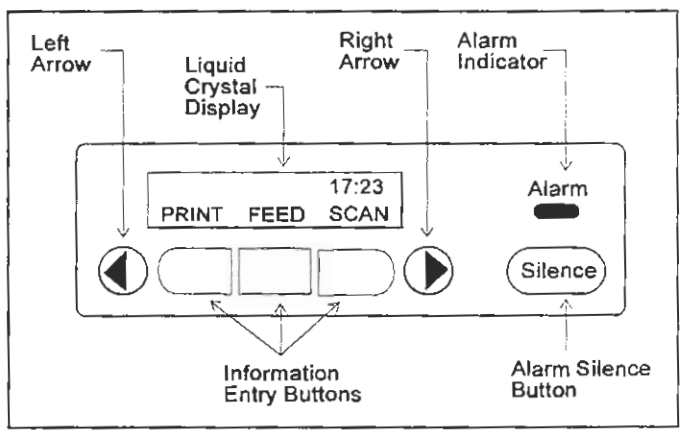


Figure 2-5
The Model 1535 Control Panel

In this screen, the three unmarked buttons are part of the Set Up menu. Pressing the button beneath Add Module, for example, brings up the series of screens used to assign channel numbers to new modules.

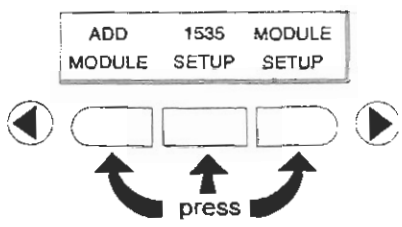


Figure 2-6
Sample Display Screen

This screen is used select the channel to program or monitor. To select another channel, press the buttons beneath UP and DOWN to change the channel number. Holding either button down scrolls the display in that direction. When the desired channel number appears, press the button beneath ENTER.

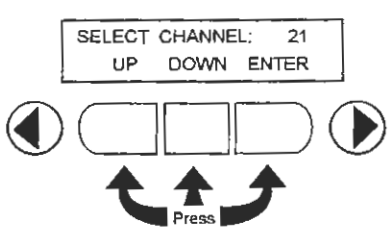


Figure 2-7
Sample Display Screen

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All instructions for programming begin with the liquid crystal display showing the Operating Screen (Figure 2-8) This is the screen that appears when the unit is first turned on and the screen display seen when the unit is monitoring the system. (When power is turned on, "Thermo Forma" and the date and time are printed by the built-in dot matrix printer.)

The following paragraphs and Chart 2-2 on the following page describes the functions of the Print, Feed and Scan button assignments shown by the Operating Screen.

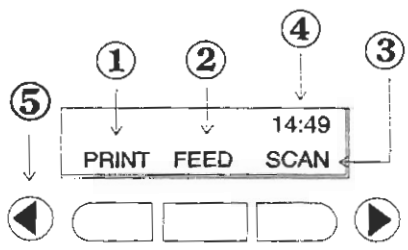


Figure 2-8
The Operating Screen

1. **PRINT** - Pressing PRINT produces a print-out of data from all of the modules connected in the system.
2. **FEED** - Pressing FEED advances 2-inches of paper out of the dot matrix printer.
3. **SCAN** - The SCAN button changes the display to a menu for viewing module settings and monitoring information. An individual channel can be selected (SELECT CHAN) or the entire system viewed in sequence by pressing AUTO SCAN or STEP SCAN.
4. **Time** - The operating screen shows the current time in 24-hour format in the upper right corner of the liquid crystal display.
5. **Display Reset** - Pressing the left arrow during the operating screen initiates the display again. The display will blank for 1 second and then return to the operating screen.

2.6 Setting the DATE and TIME

Follow Chart 2-2 to set the DATE and TIME. The DATE is entered in the month-day-year format (061595 represents June 15, 1995). The time is entered in the 24 hour format. Press the UP/DOWN keys to change the displayed digit. Press the RIGHT ARROW to move to the right one digit. The RIGHT ARROW will loop the cursor back to the start. When the desired date/time is displayed , press the ENTER key to store the new date/time to memory.

To verify the date and time settings, press the LEFT ARROW repeatedly to return to the main display. The words PRINT, FEED, and SCAN should appear in the display. Press the PRINT key. Verify the proper date and time on the printout.

Clock Accuracy: 0.004% @ 25°C (±3.5 sec/24 hours)
0.006% @ 5°C to 40°C (±5.2 sec/24 hours)

2.7 Assigning the Module Address (Channel Numbers)

With power to the Monitor/Alarm System ON, follow the steps to assign a channel number to an interface module:

1. Place the module RUN/VERIFY switch in the VERIFY position.
2. Connect the interface module to the Monitor/Alarm as shown in Figure 2-10.
3. If the green module power light is ON, move the RUN/VERIFY switch to the RUN position.
4. Follow the key sequence shown in Chart 2-3 to add a module to the system.
5. Write the channel number shown in the display on top of the module as shown in Figure 2-9: SETUP 4 DONE START NEXT
6. Write the module channel number and location on the 1535 notepad to aid in alarm correction.
7. Place the Module RUN/VERIFY switch in the VERIFY position.
8. Disconnect the interface module from the Monitor/Alarm System.

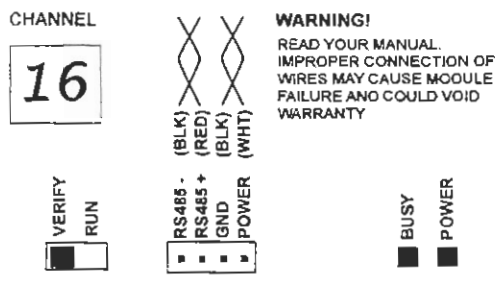


Figure 2-9
Connecting Interface Module to Monitor/Alarm

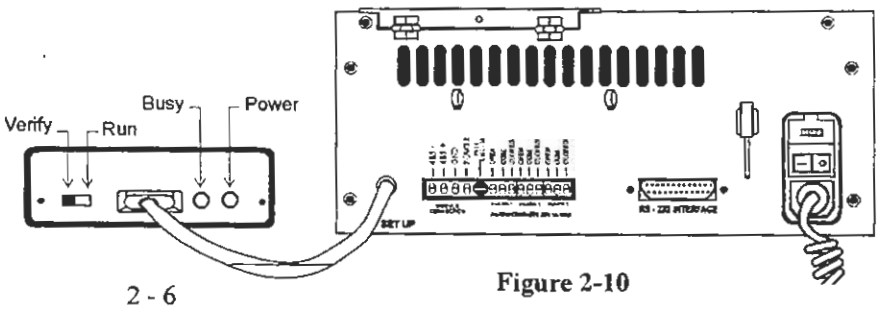


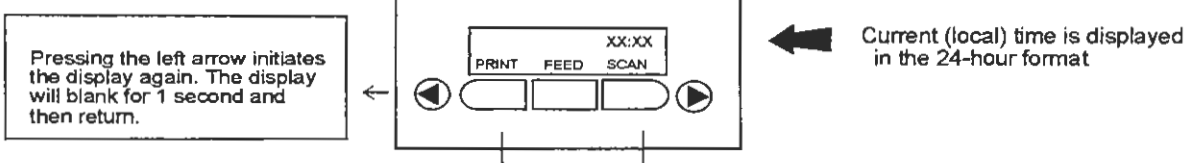
Figure 2-10

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Chart 2-1

1535

The Operating Screen: Print, Feed and Scan



Pressing the left arrow initiates the display again. The display will blank for 1 second and then return.

Current (local) time is displayed in the 24-hour format

Press PRINT

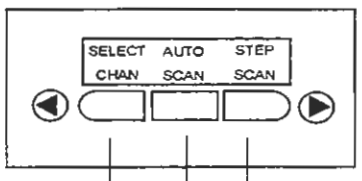
Press FEED

Press SCAN

Pressing PRINT produces a print-out of data from all modules connected in the system.
Shown are:

- Channel Number (1-24)
- Field Designator (a-f)
- Information Source (sensor)
- Informaton Type (format)
- Value
- Alarm Status

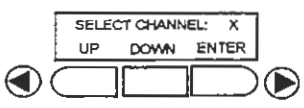
Pressing FEED once advances 2-inches of tape (paper) out of the printer



Press SELECT CHAN

Press AUTO SCAN

Press STEP SCAN



Press UP and DOWN to select channel

Press ENTER to advance to next screen

Press AUTO SCAN to automatically scroll through all channels of all installed modules, 1-24 and a-f

Or...

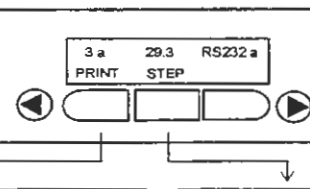
Press LEFT ARROW twice to return to the Operating Screen

Press STEP SCAN to manually scroll through all channels of all installed modules, 1-24 and a-f

Or...

Press LEFT ARROW twice to return to the Operating Screen

Press ENTER



Press PRINT to print module set-up information, a through f

Or...

Press LEFT ARROW twice to return to the Operating Screen

Press STEP to manually scroll through each channel, a through f

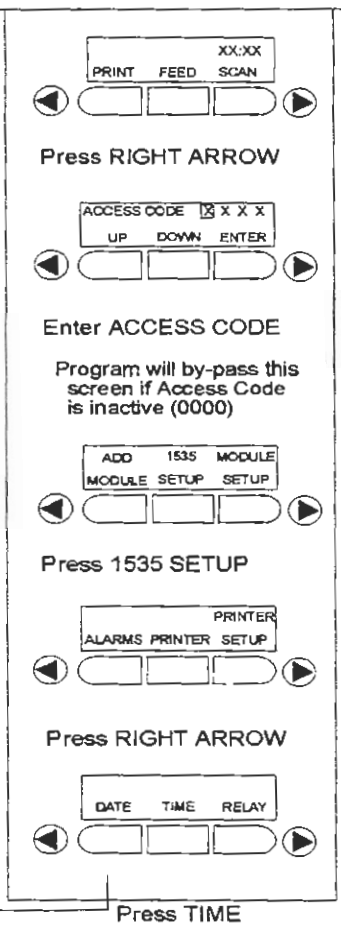
Or...

Press LEFT ARROW twice to return to the Operating Screen

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Setting the Date and Time

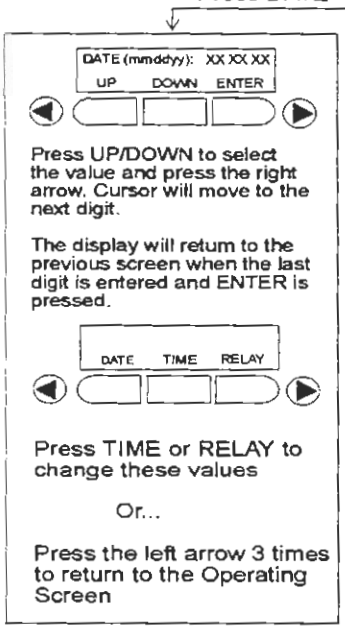
Chart 2-2
1535

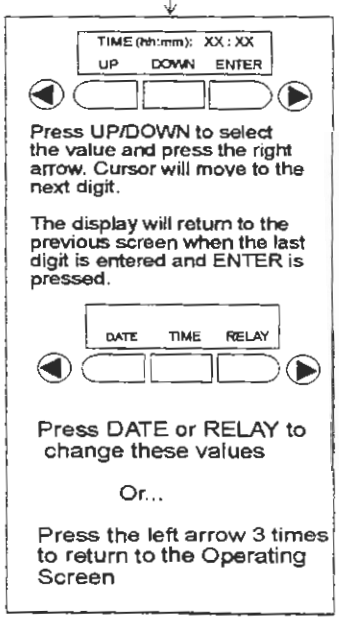


Operating Screen (Start)

Access Security Code:
Press UP or DOWN to select the first number and press the right arrow. Cursor will move to the next digit.

Display will advance to return to the previoust screen when the fourth digit is entered and ENTER is pressed.

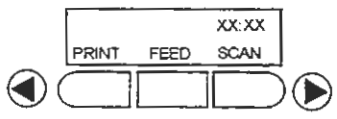




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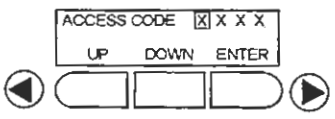
Chart 2-3
1535

Assigning an Address (channel number) to a Forma Interface Module



Operating Screen (start)

Press RIGHT ARROW

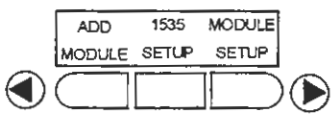


Program will by-pass this screen if the Access Code provision is not active
Or...

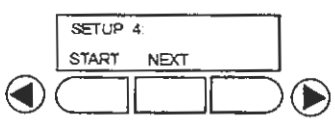
Enter ACCESS CODE

Use UP and DOWN to select the first number and press RIGHT ARROW. Cursor will move to the next digit.

Display will advance to the next screen when the fourth digit is selected and ENTER is pressed.

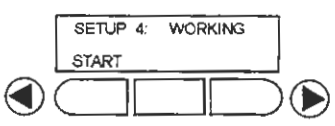


Press ADD MODULE

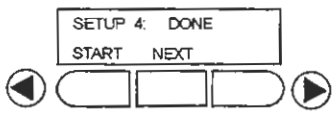


Press START

Press START to assign the number shown to the module
Or...
Press NEXT to advance to the next available module number
Display will show ALLOCATED if the number is already in use



Display will flash WORKING



Display will change to DONE when setup is completed
Or...
Show ERROR. Press START again to setup
Or...
Press NEXT to advance to the next available module number.

Press LEFT ARROW twice

To return to the OPERATING SCREEN

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2.8 Loading the Printer Paper

Access to the built-in dot matrix printer is made by raising the metal cover on the top of the Alarm/Monitor cabinet. Do not raise the cover by inserting the fingers into the paper exit slot. Very sharp serrations are located in this slot which may cause cuts and abrasions. Raise the cover instead by inserting a fingernail or fingertip into the leading edge of the cover.



Do not raise the printer cover by inserting fingertips into the paper exit slot. A sharp serrated edge is located in the slot which is used to tear the paper and could cause cuts or abrasions.

The Alarm Monitor printer uses rolled paper which is fed from a spool located on the printer cover. When replacing the paper, attach the roll onto the spool holder so that the paper feeds over the back of the roll and downward. Insert the end of the paper into the slot on the back of the printer carrier as shown in Figure 2-11. An embossed arrow is located on the metal feed tray to assist in finding the feed slot.

Press the Feed button (the center button when viewing the Operating Screen) while inserting the end of the paper roll into the feed slot. A single press of the Feed button will extend about 2 inches of paper.

Make sure the paper extends past the print head and ribbon.

Pass the paper from the printer through the serrated slot. Close the printer cover when the paper path is completed.

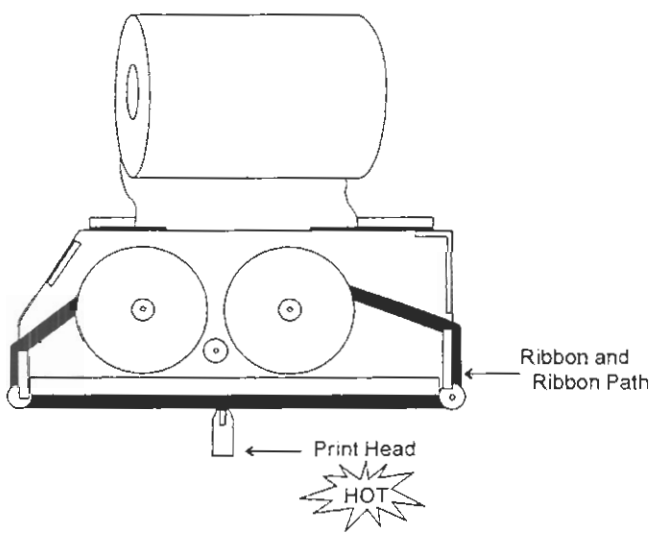


Figure 2-11
Installing the Printer Ribbon and Paper

Section 3 - Connecting Interface Modules to Laboratory Equipment

3.1 Installing the RS-232 Module, Kit P/N 190458

Kit 190458 will connect the 1535 with the following Thermo Forma products:

Incubators	ULT Freezers
3193	8400 Series
3194	8500 Series
3195	
3196	
3250	

Refer to Drawing 190458-70-0-D following.

Note: When using an RS-232 Module, the alarm delays for each channel/field must be set for 1 minute or longer (refer to Section 5.4D) to allow the module to receive and process the RS-232 data being transmitted from the equipment being monitored.

3.2 Installing the Analog Module, Kit P/N 190459

Kit 190459 will connect the 1535 with the following Thermo Forma products:

3033	3548	3035	3860	3154	3862	3158
3940	3159	3949	3164	3980	3165	3986
3173	3179	3326	3327	3332	3336	3337
3342	3354	3546				

Refer to Drawings 190459-70-0-D and 190459-71-0-D, following.

3.3 Installing the RTD Modules, Kit P/N 190456 and 190457

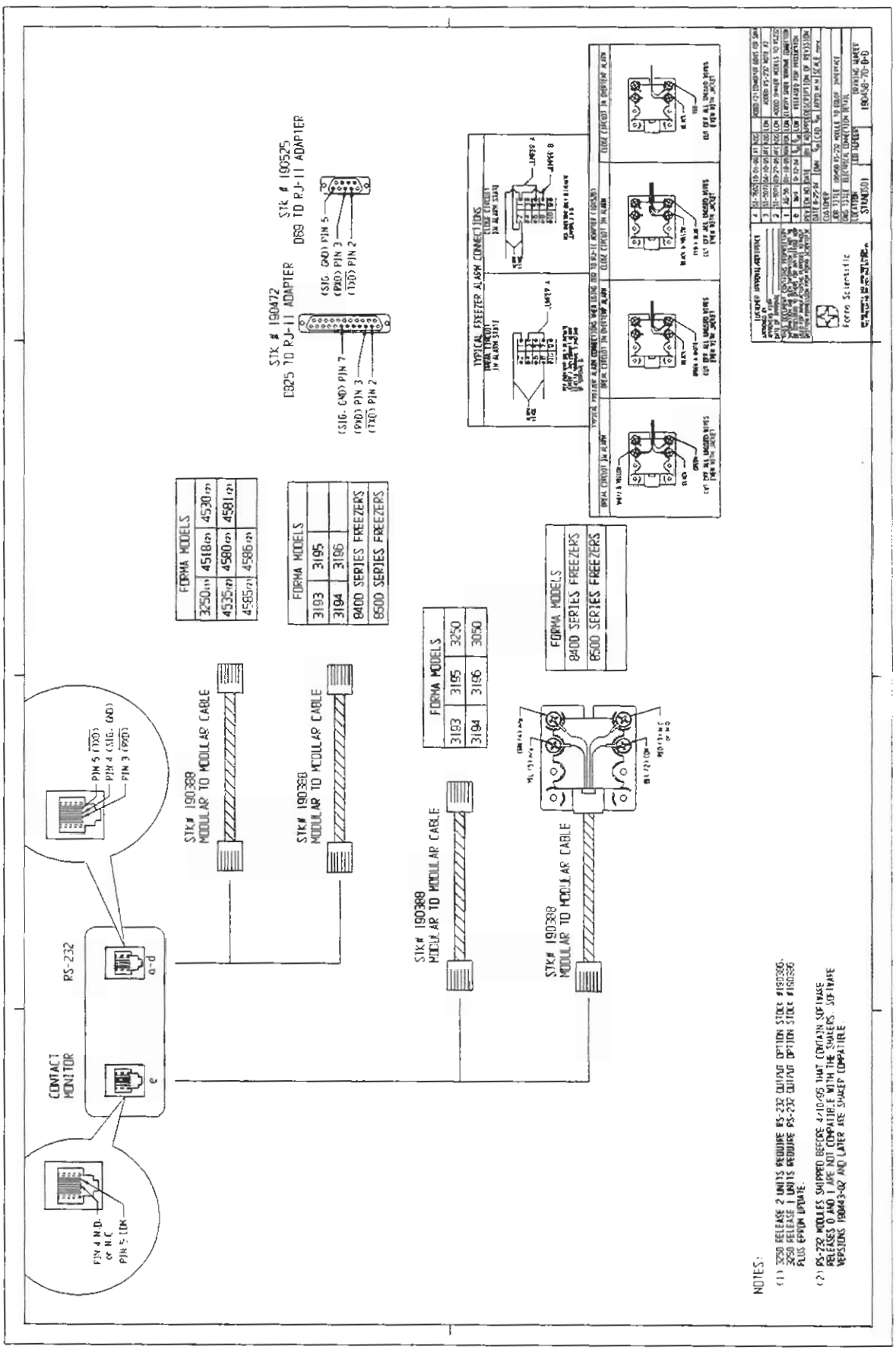
Kit 190456 will connect the 1535 with the following Thermo Forma Cryopreservation products:

8022	8043	8057	8068	8140	8160	8174
8023	8046	8058	8069	8149	8161	8175
8024	8047	8059	8071	8150	8162	8176
8025	8050	8061	8072	8151	8163	8177
8026	8051	8062	8073	8152	8164	8178
8027	8052	8063	8074	8153	8165	8179
8053	8064	8075	8154	8166	8180	8054
8065	8077	8155	8167	8055	8066	8078
8156	8172	8056	8067	8157	8173	

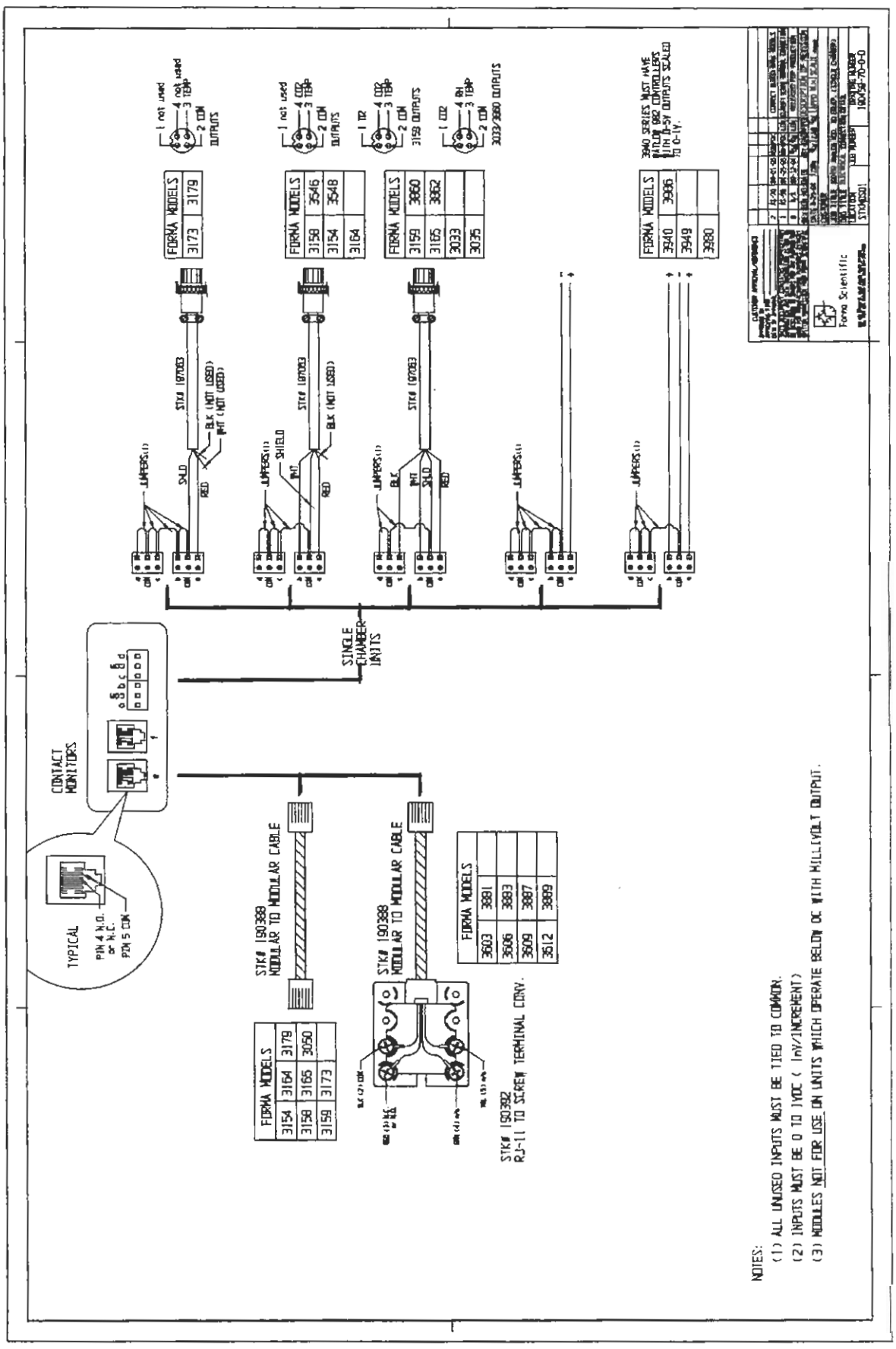
Refer to Drawing 190456-70-0-D following, for temperature probe applications -200°C to -90°C.

Refer to Drawing 190457-70-D following, for temperature probe applications -90°C to +70°C.

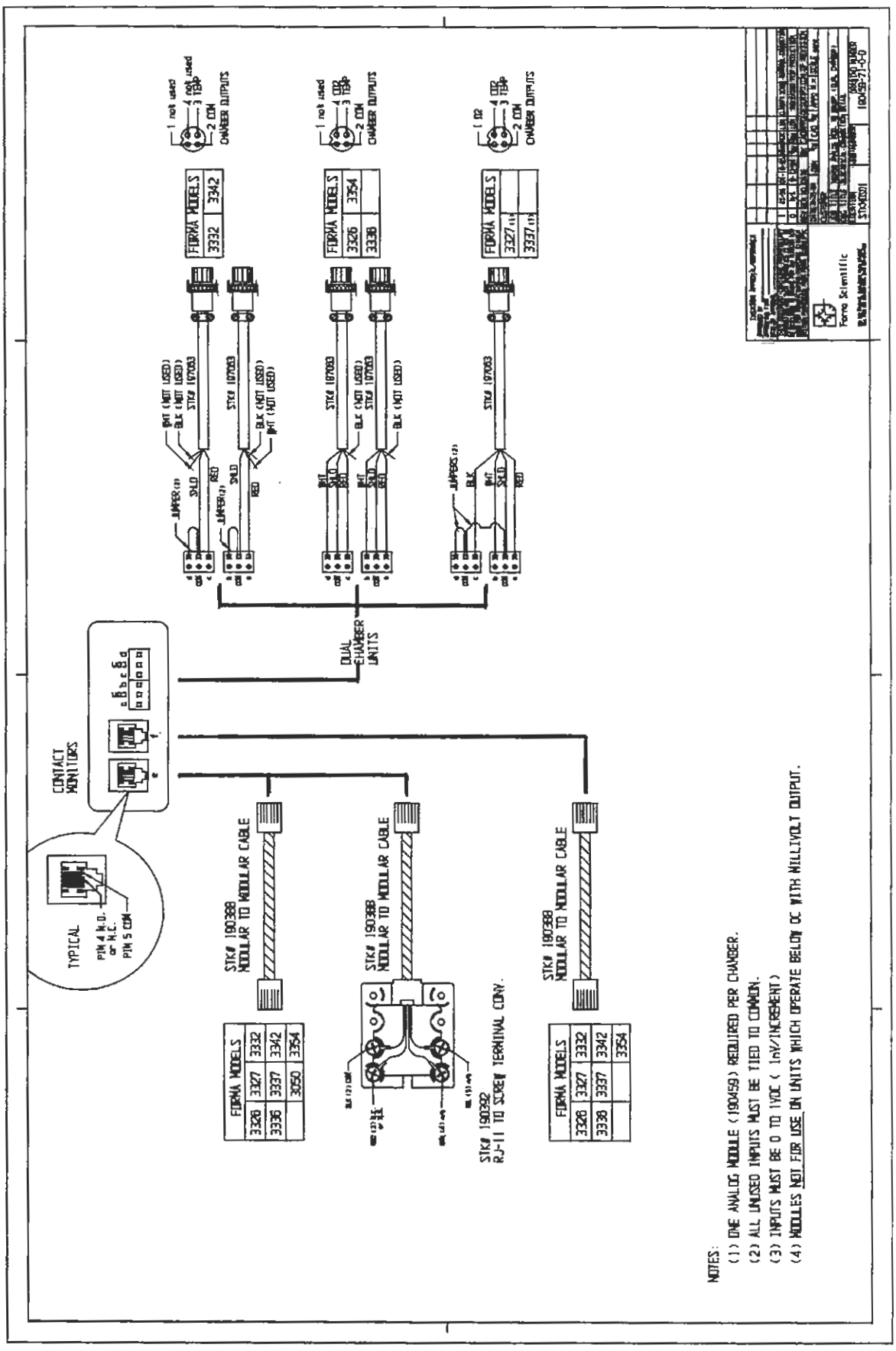
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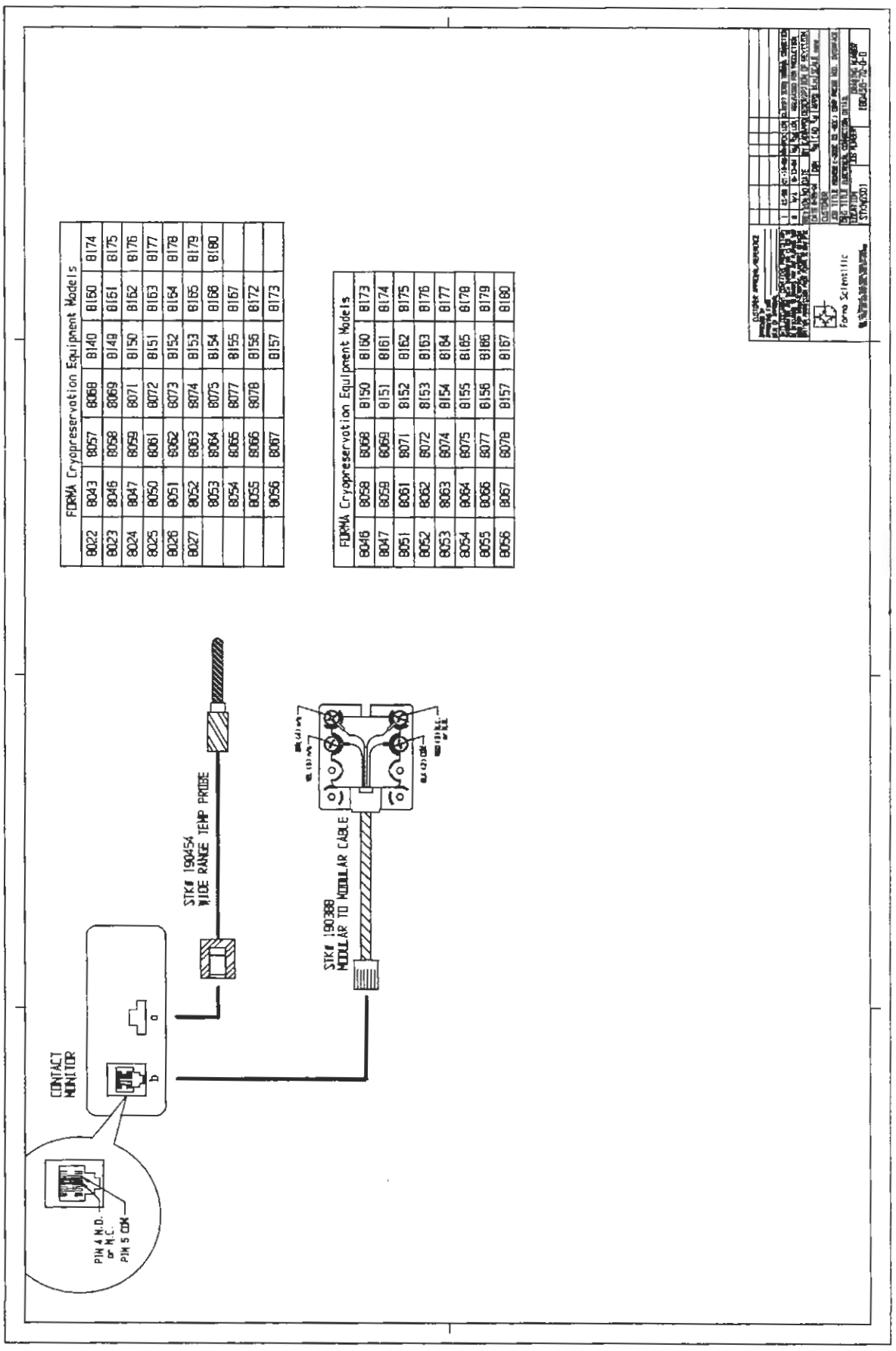
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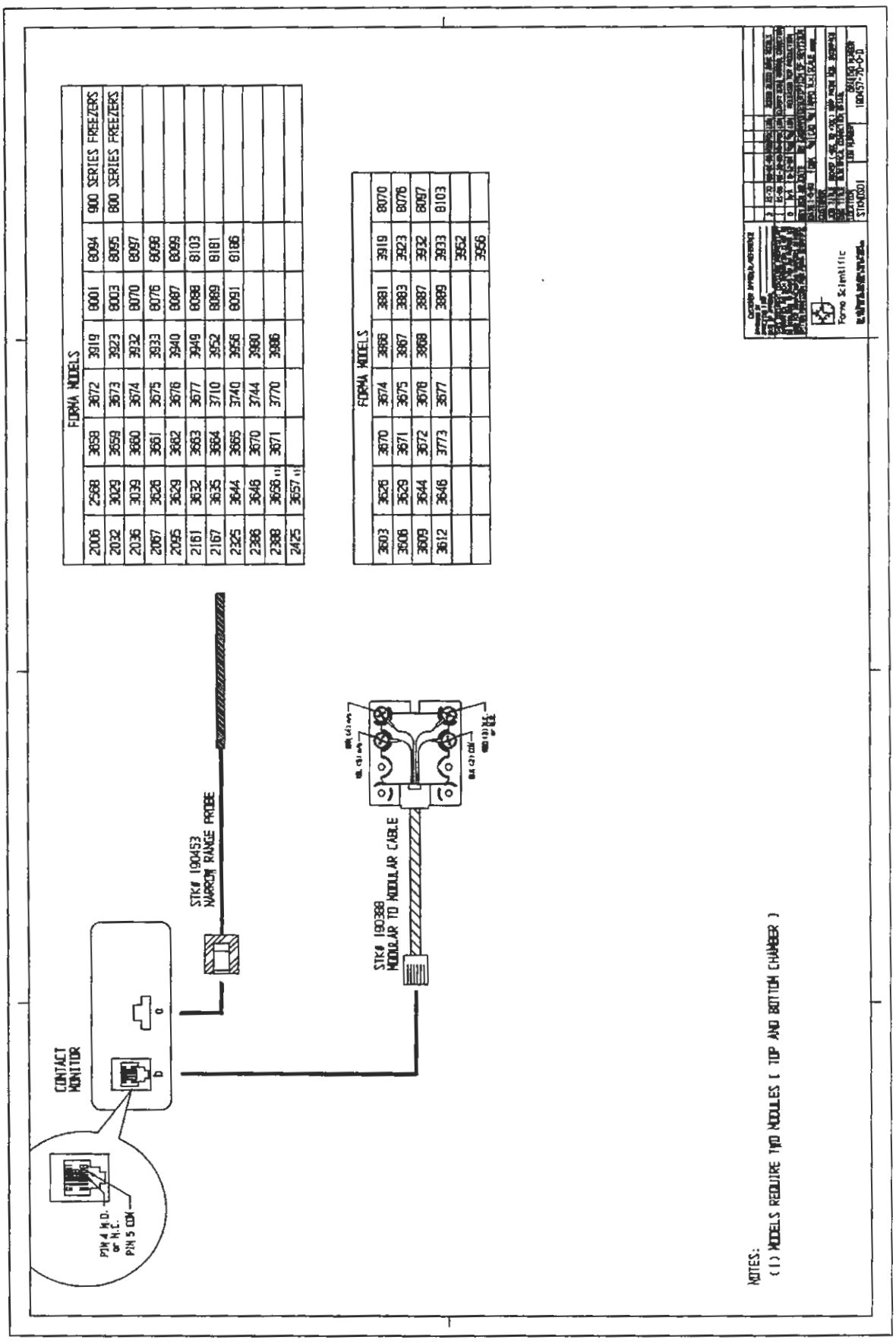
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Section 4 - Connecting Modules to the 1535

4.1 Installing the Alarm Network

The Interface Modules are connected to the Model 1535 by a four-wire cable. This cable must consist of a twisted pair of 18 gauge wires and a twisted pair of 22 gauge wires. The larger wires carry the electrical current for the modules, the smaller sized twisted pair carry the signals and information. Use the releasable tie wrap and anchor on the back of the 1535 to secure the connections.

a. Series Connection (Daisy Chain - Refer to Drawing 1535-71 at the end of Section 4)

The preferred method of connecting the Interface Modules to the Monitor/Alarm is in series or a "Daisy Chain" arrangement. Electrical connections start from the module connector on the back of the Model 1535 to the module connector on the first Interface Module. The second Interface Module is then wired from the module connector on the first Module. The third Module is connected to the connector on the second Module, and so on. Wiring the system in this manner, the equipment being monitored can be as far away as 2000 feet from the Monitor/Alarm. Figure 4-1 shows the Monitor/Alarm system in a Daisy Chain installation.



Do not plug or unplug the four-wire cable connector into the back of the 1535 while power is turned on. It will damage the electronics in the Monitor/Alarm. Also, turn off power to the 1535 whenever wiring modifications are to be made to the system. Shorting power/ground wires to the signal wiring can potentially damage any modules connected to the system. Place the Run/Verify switch in the Verify position before connecting or disconnecting the four-wire cable connector from the module.

b. Alternate Connecting Method ("Y" Tap Connection, refer to Drawing 1535-71 at the end of Section 4)

The Interface Modules may also be connected to the Monitor/Alarm by installing a long run of the four-wire cable and connecting the modules to it, using self-stripping electrical tap connectors. Because of the electrical characteristics created by this type of installation, the maximum distance between the Monitor/Alarm and the farthest module is limited to 1000 feet. (Figure 4-2) The total amount of cable in the system is limited to 2000 feet. A 4-wire Daisy Chain and Y-Connection drawing follows.

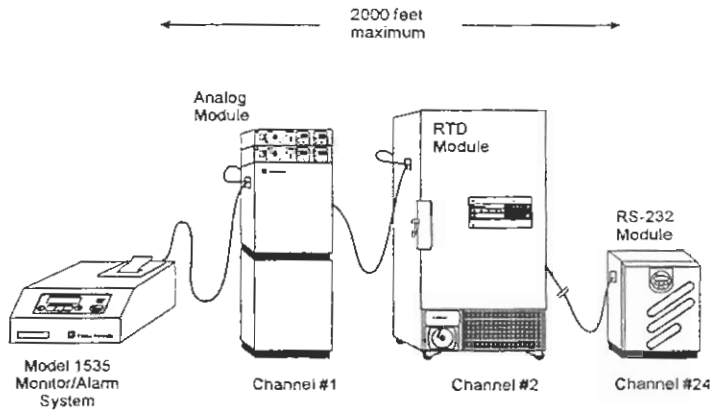


Figure 4-1
Connecting the Monitor/Alarm in a Daisy Chain Series

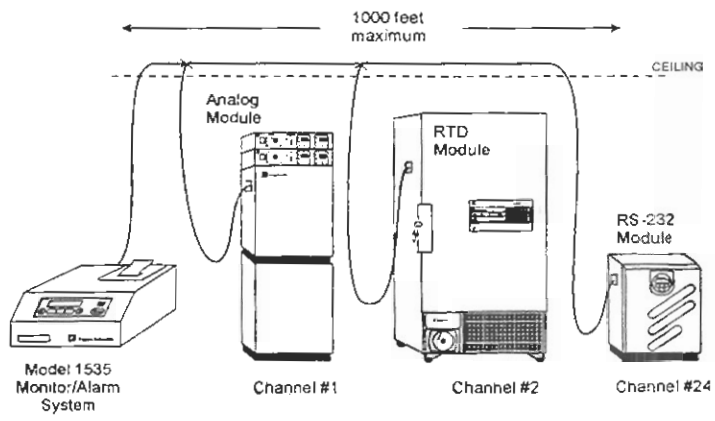


Figure 4-2
Connecting the Interface Alarm Modules with a Y-Connection



When installing any module for the first time on the alarm network, the Run/Verify switch must be in the Verify position. If the green Power LED lights on the module when power is applied to the system, all wiring is correct and the switch can be turned to Run. If the Power LED does not light, wiring is not correct and the system should be thoroughly checked.

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4.2 Monitoring a Shaker with the RS-485 Option

Thermo Forma Orbital Shakers can be purchased with the optional RS-485 data output. The shakers do not require an interface module and can be directly connected to the 1535 using the Thermo Forma connector cable assembly number 197067.

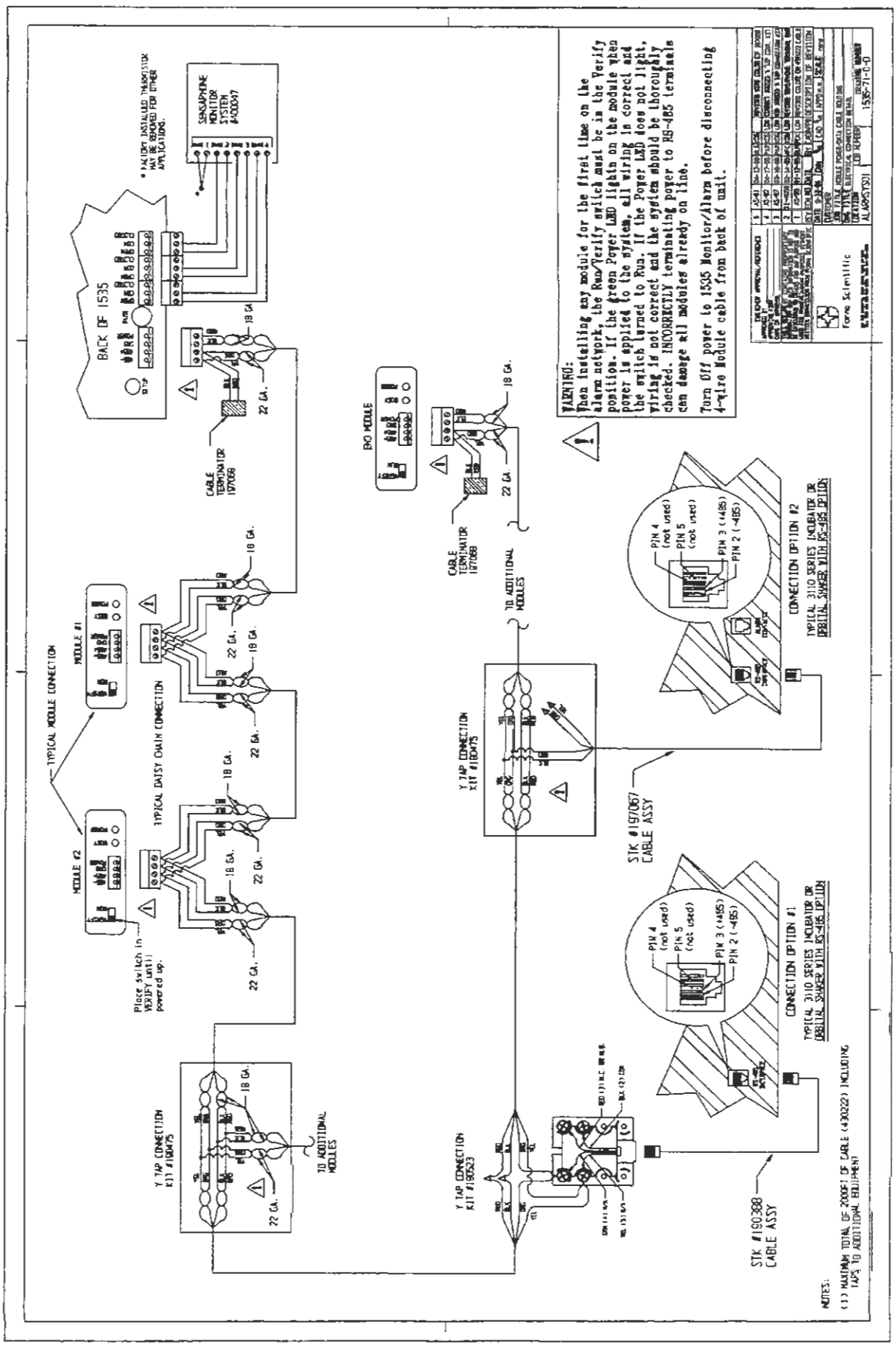
To allow the 1535 and the shaker to communicate, allocate a module on the 1535 as described in Section 5.8. The same number that is allocated on the 1535 needs to be assigned to the shaker. Refer to the shaker instruction manual.

4.3 Monitoring a Model 310, 3110 or 3950 Series Incubator with the RS-485 Option

Thermo Forma Model 310, 3110 and 3950 Series incubators can be purchased with the optional RS-485 data output. The incubators do not require an interface module and can be directly connected to the 1535 using the Thermo Forma connector cable assembly, number 197067.

To allow the 1535 and the incubator to communicate, allocate a module on the 1535 as described in Section 5.8. The same number that is allocated on the 1535 needs to be assigned to the incubator. Refer to the incubator instruction manual, Section 6.1b, Connecting the RS-485 Interface (190523).

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Section 5 - Programming the Interface Modules

5.1 Programming the Modules

Each interface module connected to the Model 1535 may send up to 6 pieces of data to the Model 1535. Each of these pieces of data (fields a-f) may be individually configured to signal an alarm under the desired condition and to produce the desired output logs.

The following steps must be performed before attempting to configure an individual data field:

1. The module has been assigned a channel number (1-24) as described in Section 2.7.
2. The module is connected to the laboratory equipment as described in Section 3.
3. The interface modules have been wired together as described in Section 4.
4. Power is applied to the Monitor/Alarm network and the green Power light on the module is ON. The red Busy light on the module blinks whenever data is being sent to the 1535.

Table 5-1 lists the individual parameters that may be programmed for each data field.

Table 5-1
Programmable Interface Module Settings
(Defaults are shown in parentheses)

Parameter	Variable	Defaults
Calibration offset/invert		(ϕ.ϕ)
Alarm enable/disable	ON/OFF	OFF
High and low limits		(ϕ.ϕ)
Alarm type*	Latching/momentary	momentary
Alarm delay time	Minutes, 0-60	(ϕ)
Alarm contact 1	ON/OFF	ON
Alarm contact 2	ON/OFF	ON
Alarm contact 3	ON/OFF	ON
Printer status	ON/OFF	ON
RS232/FDD	ON/OFF	OFF
5-character print descriptor	°C, CO_2, %RH, mV and others	

**Alarm type (latching or momentary) can be overridden through "1535 Set-Up".*

5.2 Locating the Desired Data Field Using SELECT CHAN and AUTO/STEP SCAN

Press the SELECT CHAN to proceed directly to a particular module. If module 10 is selected, the display will begin with 10a (module 10 field a). To proceed to field e, press the STEP key repeatedly until 10e appears in the display. The STEP key makes the display sequentially proceed to the next active data field.

Pressing the AUTO SCAN key will display the first active data field (usually 1a). This field will be displayed for about 5 seconds. The next active field is then automatically displayed for 5 seconds. After all fields have been displayed, the cycle will repeat. To stop the scan, press the STEP key anytime during the automatic scan.

5.3 Calibrating

Follow Chart 5-1 to calibrate a data field. See Section 5.2 to help locate the desired data field.

To calibrate a numeric data field, press the CAL key as shown in Chart 5-1. Press the UP/DOWN keys to change the displayed value. When the desired setting is shown in the display, press the ENTER key to store the new calibration values to memory.

Contact values can not be calibrated like numeric values. The contact state can be inverted. Contact states are either NORMAL or ALARM. Pressing the INVERT key will toggle the displayed contact state from NORMAL to ALARM or vice versa.

5.4 Alarm Configuration

Follow Chart 5-1 to set the desired conditions to activate an alarm for a data field. See Section 5.2 to help locate the desired data field. Press the ALARM key and follow Figure 5-1 to customize the alarms.

a. ALARM ON/OFF

ON: If the data field value exceeds the high or low alarm limit for longer than the alarm delay, the red alarm light is activated and an alarm message appears in the display.

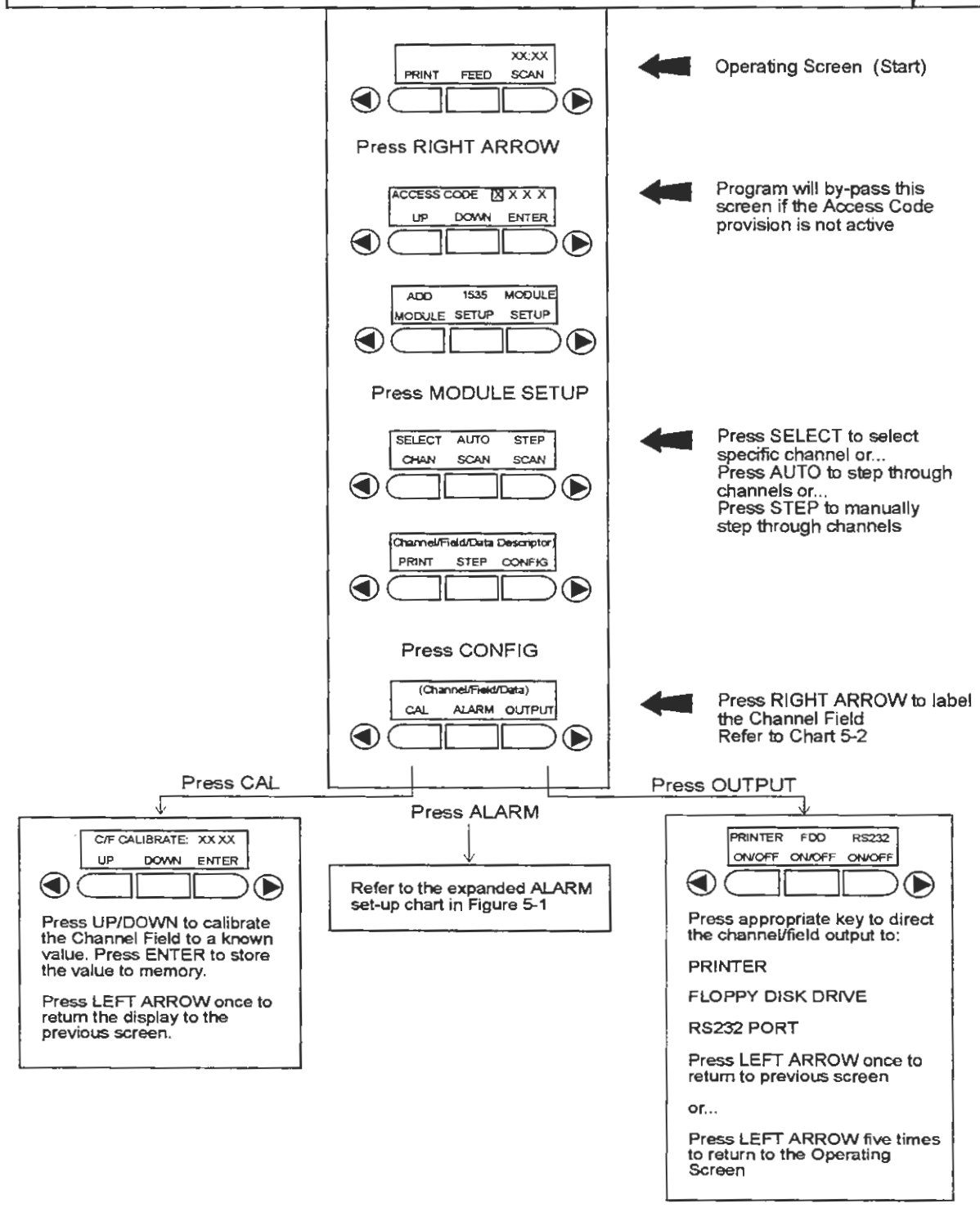
OFF: No limit checks are performed on the data field value. No alarms messages will appear in the display for this data field and no alarm relays can be activated by this data field.

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Configuring the Channels and Fields

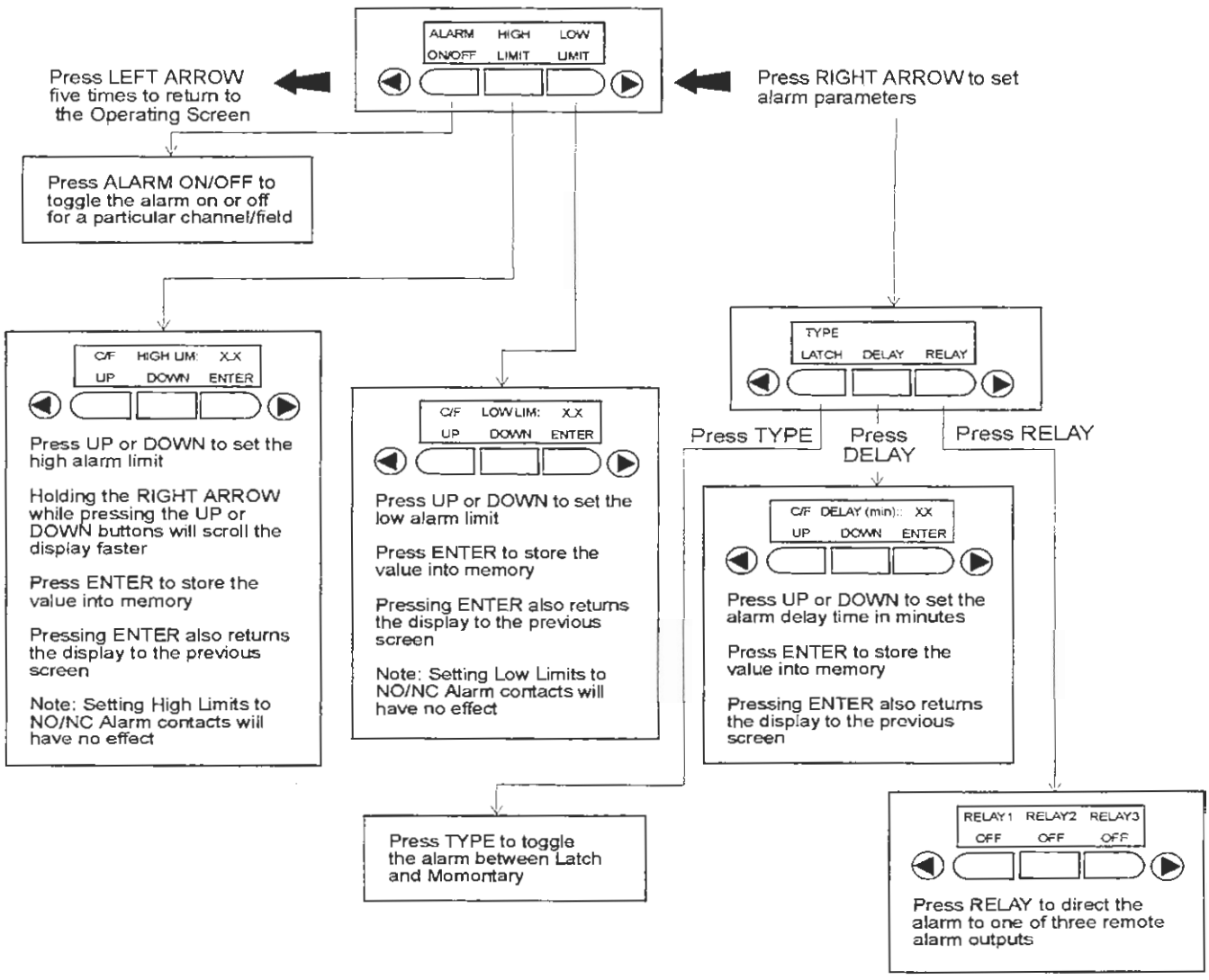
Chart 5-1

1535



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From the CAL/ALARM/OUTPUT screen



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b. HIGH LIMIT / LOW LIMIT

Press the UP/DOWN keys to change the displayed value for the high/low limit. When the desired setting is shown in the display, press the ENTER key to store the new setting value to memory.

To make the displayed value change at a faster pace, press and hold the right arrow key while simultaneously pressing the UP/DOWN key.

The HIGH LIMIT is always greater than the LOW LIMIT. For example, with a -80°C freezer, the low limit may be set to -85°C and the high limit to -75°C.

c. ALARM TYPE (Momentary or Latching)

The alarm type can be either MOMENTARY (default) or LATCHING Pressing the TYPE key will toggle the type between the two types. Both momentary and latching alarms are displayed when an alarm condition exists. When the alarm condition has been corrected, momentary alarms are removed from the display automatically. When the alarm condition has been corrected, latching alarms continue to be displayed until the alarm condition has been acknowledged (cleared) by the user.

d. Alarm DELAY time

Press the UP/DOWN keys to change the displayed value for the alarm delay. When the desired setting is shown in the display, press the ENTER key to store the new setting value to memory.

The valid delay time range is 0 (default) to 60 minutes.

A data field value must be exceeding the high or low limits for this amount of time before the alarm is activated. This is useful to prevent nuisance alarms caused by such things as door openings.

Alarm delays must be programmed for 1 minute or longer on RS-232 modules to allow the module to receive and process data transmitted from the equipment being monitored.

e. Alarm Relay 1-3

The 1535 contains 3 relays that can be activated by alarm conditions. An alarm condition on the particular data field will activate all three relays by default. An alarm relay can be activated by one specific alarm condition by configuring all the other data fields to have that specific alarm relay OFF. For a printout of all the data fields that will activate each alarm relay, see Section 6.10 and Chart 6-5.

5.5 Data Logging (OUTPUTS)

Follow Chart 5-1 to direct the data field value to an output device (printer, RS-232, or FDD). See section 5.2 to help locate the desired data field. Press the OUTPUT key to display the available output devices. Press the desired device key to toggle the output device ON/OFF .

The data field value can be logged to any combination of OUTPUT devices. The output devices include the 1535 printer, the RS-232 communication port, and the optional floppy disk drive.

PRINTER (DEFAULT)	ON :	The module number (1-24), data field (a-f), and the data field value will be logged on the 1535 printer
	OFF:	The module number and data field will not be printed by the 1535 printer
RS232	ON :	The module number (1-24), data field (a-f), and the data field value will be logged on the RS-232 communication port
(DEFAULT)	OFF:	The module number and data field will not be transmitted on the RS-232 output
FDD	ON :	The module number (1-24), data field (a-f), and the data field value will be logged on the floppy diskette
(DEFAULT)	OFF:	The module number and data field will not be stored to the floppy diskette.

5.6 Labeling the Data Field

Follow Chart 5-2 to select a label for a data field value. See Section 5.2 to help locate the desired data field. Press the NEXT key to view the available labels. When the desired setting is shown in the display, press the ENTER key to store the new label to memory.

The labels available are listed in Table 5-2.

Table 5-2
Field Labels

C	%CO2	state	%O2
%RH	F	mV	RPM
MIN	HOUR	RS232/Alog/RTD	

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Figures 5-2 and 5-3 show typical printer tapes with and without labels asssigned.

In the printer tape shown, Channel 1 is an RTD module. The temperature probe is reading 24° and the NO/NC contacts are in the normal (non-alarm) state.

Channel 2 is an RS-232 module connected to an incubator. The temperature is 33.8, the CO_2 concentration is 5.0 and the relay contacts are in the normal (non-alarm) state.

Channel 3 is an Analog module monitoring a stacked incubator. The information shown is that the temperature in one chamber is 33.8, the CO_2 content is 5.0 and the relay contacts are in the normal (non-alarm) state.

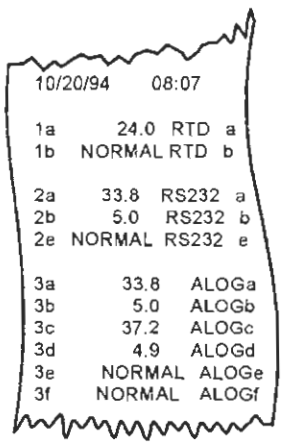


Figure 5-2

The temperature in the second chamber is 37.2, the CO2 concentration is 4.9 and the relay contacts are in the normal (non-alarm) state.

The figure at right shows the printer tape with the labels assigned. The labels replace the module type (RTD, RS232, ALOG) and lower case letter (a through f) on the far right of the data field.

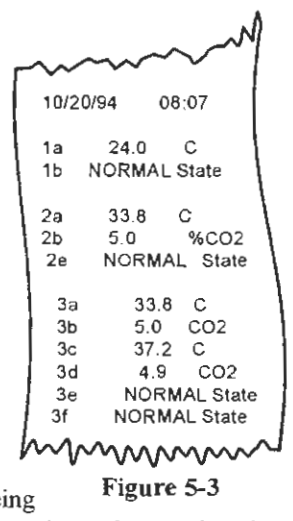


Figure 5-3

5.7 Removing Unused Data Fields

Data fields that are not being used may be removed from the system to improve system performance. Examples of unused data fields include contacts that are not being monitored, extra RS-232 fields that contain no data, and analog input values that are not connected.

If the data field is not going to be used for a short period of time, turn the data field alarm OFF and the data field output printer OFF. See Sections 5.4 and 5.5

To remove the field permanently, see Chart 5-2. Pressing the REMOVE key will delete the field from the system. The next data field in the system then appears in the display. Once removed, the field can be reassigned only by completely reprogramming the interface module.

5.8 Allocating and Deallocating a Channel

Used rarely, a channel can be completely deallocated (removed) from the monitor/alarm system. Doing so, the channel can only be returned to use by Allocating it and following the regular set-up routine.

Allocating a channel is necessary when Thermo Forma equipment, (e.g., Orbital Shaker) which has RS485 communications built-in, is installed in the system. There is no interface module required and therefore no module to program. By allocating a 1535 channel number for that equipment and then allocating that same channel number in the unit's program, the two are able to communicate.

Follow the instructions in Chart 5-3 to deallocate (remove) or allocate (add) a channel to the Monitor/Alarm System without using the setup port. Press the NEXT key to change the channel number shown in the display. When the desired channel number is shown in the display, press the ENTER key to allocate/deallocate the channel. A list of allocated/deallocated channels will be printed when the PRINT key is pressed.

5.9 Checking the RS-485 Data Format

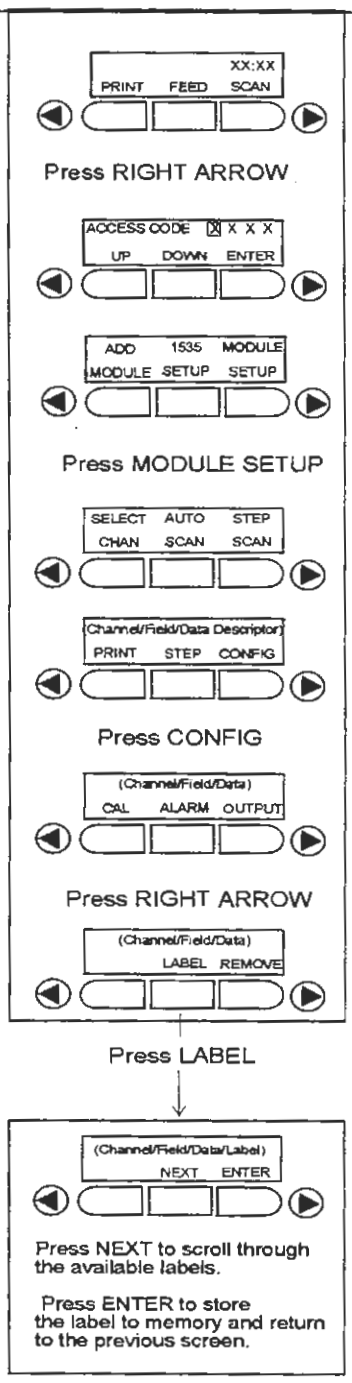
The RS-485 data format is: 9600 Baud
Checksum Yes
Parity No

To verify the data format, follow the instructions in Chart 5-3 and press the key labeled RS485 COMM.

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Chart 5-2
1535

Labeling the Data Fields and Removing Unused Data Fields

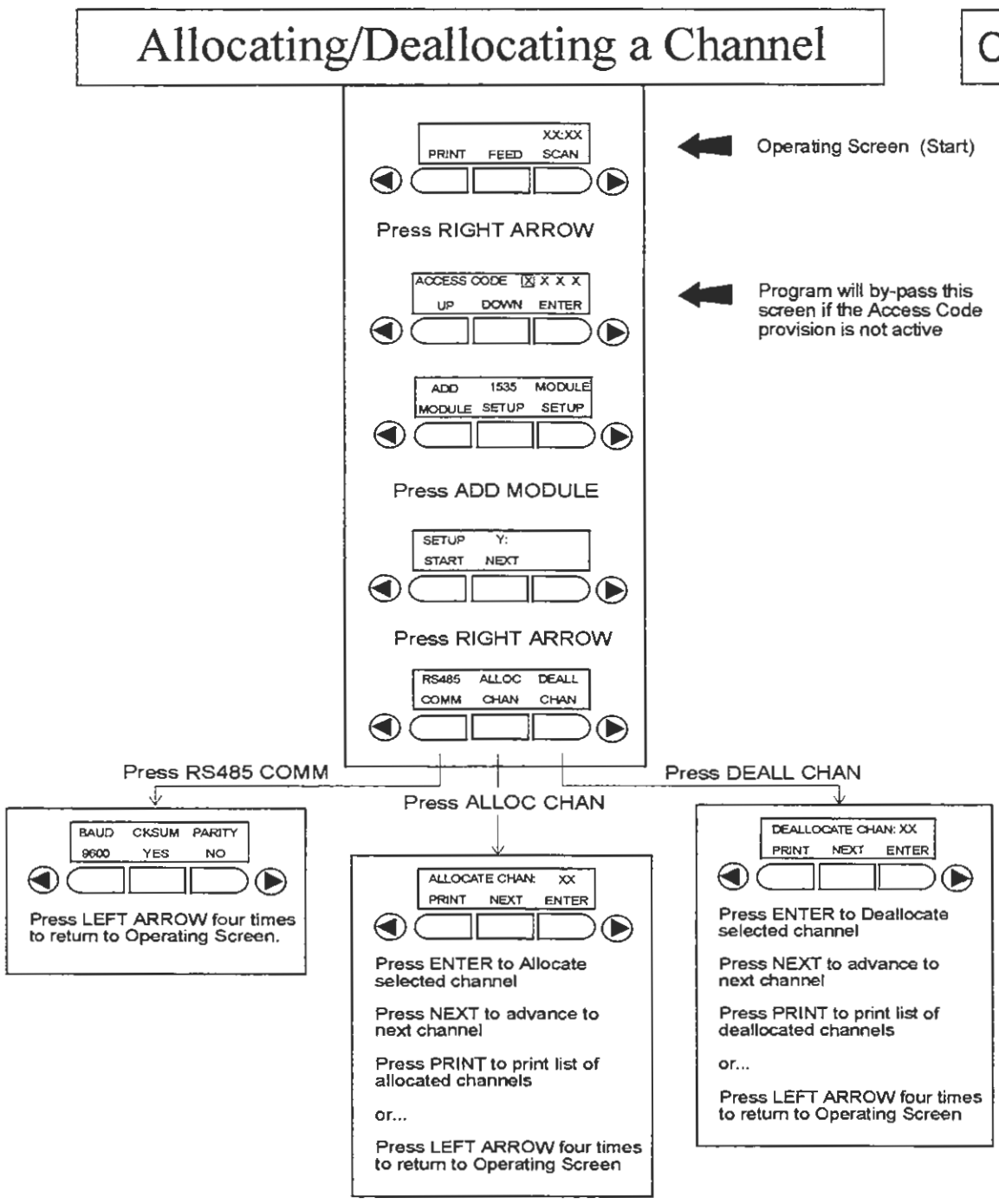


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Allocating/Deallocating a Channel

Chart 5-3

1535



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Section 6 - Programming the Model 1535 Monitor/Alarm

6.1 Programming the 1535

The Model 1535 is a microprocessor-based monitor/alarm featuring a visual display, entry keys and a built-in dot matrix printer. The operating system is menu driven, using a progression of display screens to program the unit, change information parameters, set alarm points and create permanent records.

Table 6-1 lists the programmable parameters in the 1535 that affect the entire system operation. See Section 5 to program a parameter that is specific to one particular interface module data field.

The Model 1535 monitors up to 24 individual channels at a rate of two channels per second. Each channel can contain as many as six data fields. The channels are assigned and the interface modules programmed using five buttons and the LCD display on the Monitor/Alarm control panel.

Three sets of "dry" relay contacts and an RS-232 connector are provided for remote alarm and data outputs and a built-in 3.5" diskette drive is available as an option.

For help getting started and operating the control panel, see Section 2.5.

6.2 Printing the Parameter Settings

A hard-copy of the Monitor/Alarm set-up information can be printed by the built-in printer. This printout is useful to verify existing settings. Follow Chart 6-1 to obtain a printout of the desired settings.

For an overview of the entire 1535 system parameters, press the ALL key. An example of the listing produced when the ALL key is pressed is shown in Figure 6-1. Individual sections of Figure 6-1 can be obtained by pressing the key associated with that section.

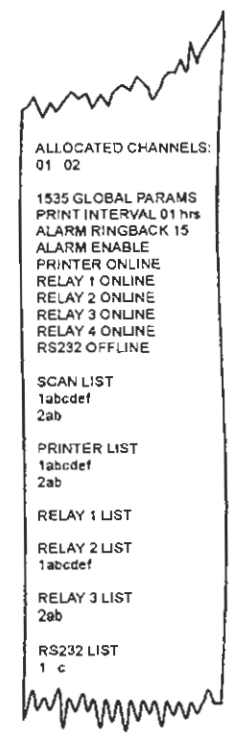
For a detailed view of an individual module, press the CHAN key and select the desired channel number. This printout details the alarm settings for the entire interface module. See Figure 6-2 for an example printout, detailing Module 2.

Table 6-1
Programmable Settings

PARAMETER	VARIABLE	DEFAULT
ALARMS		
Audible	ENABLE(On)/DISABLE(Off)	On
Ringback	minutes (1-60)	15 minutes
Type*	Sets all alarms to momentary/latching	momentary
PRINTER		
Status	ENABLE(On)/DISABLE(Off)	ON
Interval	1 minute to 1 day	1 hour
RELAYS		
Relay #1	ENABLE(On)/DISABLE(Off)	ON
Relay #2	ENABLE(On)/DISABLE(Off)	ON
Relay #3	ENABLE(On)/DISABLE(Off)	ON
ACCESS CODE	0000 - 9999 Prevents unauthorized access	0000
RS-232		
Status	ENABLE(On)/DISABLE(Off)	OFF
Interval	1 minute to I day	1 hour
Data type	Line or Table type	LINE
Column width	80 - 300 columns	80 columns
Paper length	40 - 200 lines	60 lines
FDD		
Status	ENABLE(On)/DISABLE(Off)	OFF
Interval	1 minute to 1 day	1 hour
Data type	Line or Table type	LINE
File length	I - 800 hour	24 hour

**Setting the Alarm type on the Model 1535 under "1535 Set-Up" overrides the Alarm type programmed for each module under Module Set-Up.*

Figure 6-1
System Parameters



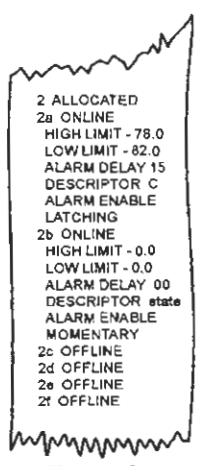
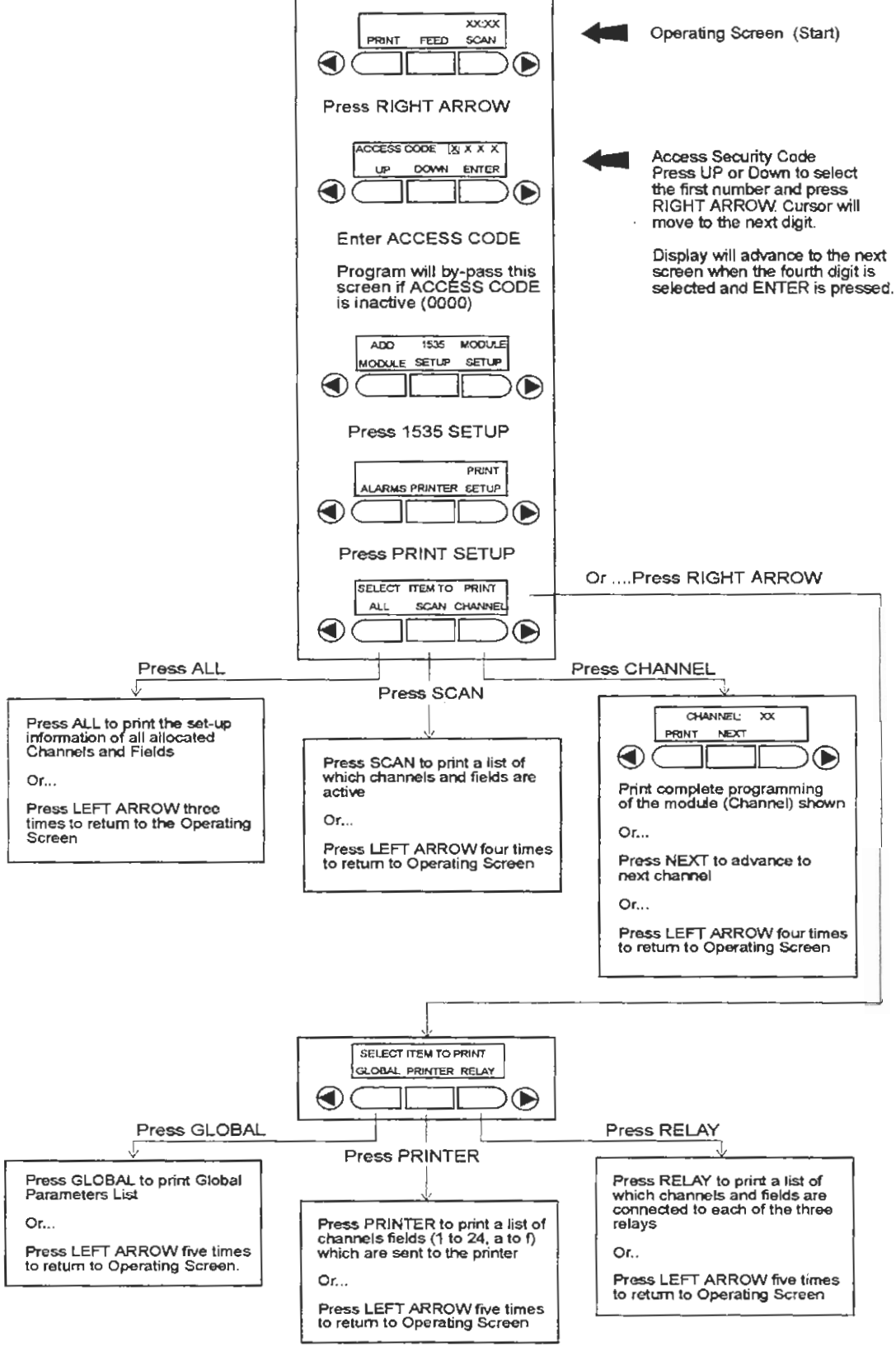


Figure 6-2
Module Parameters

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Printing Set-Up Information

Chart 6-1
1535



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6.3 Setting Alarm Parameters

a. Enabling/Disabling the Audio Alarm

Follow Chart 6-2 to enable/disable the audio alarm. Press the AUDIO key to toggle the setting between ON and OFF.

AUDIO ON: Alarm conditions produce an audible alert signal along with the flashing red alarm light

AUDIO OFF: Alarm conditions will flash the red alarm light. The audible alarm will remain silent.

b. Setting the Ringback Time

Follow Chart 6-2 to set the ringback time. The ringback time is the amount of time from silencing the audible alarm until the audible alarm sounds again. The ringback time defaults to 15 minutes but may be set from 1 to 60 minutes.

Press the UP/DOWN keys to change the displayed value for the ringback time. When the desired setting is shown in the display, press the ENTER key to store the new setting value to memory.

c. Configuring the Alarm Type

Follow Chart 6-2 to set all the data field alarms to the desired type. See Section 5.4 C for definitions of latching and momentary alarm types.

Press the TOGGLE key to change the displayed value for the alarm type. When the desired setting is shown in the display, press the ENTER key to change all the alarms currently in the system to this type.

6.4 Setting Printer Parameters

a. Enabling/Disabling the Printer

Follow Chart 6-3 to enable/disable the printer. Press the PRINTER key to toggle the printer ON and OFF.

PRINTER ON: The built-in dot matrix printer will automatically print the system status at the scheduled intervals and alarm occurrences

PRINTER OFF: No automatic printing at the scheduled intervals or alarm occurrences

b. Setting the Print Interval

Follow Chart 6-3 to set the desired print interval. Press the NEXT key to cycle through the available interval settings. When the desired interval is shown in the display, press the ENTER key to store the new interval to memory. The hour and day intervals begin when the ENTER key is pressed. For example, if the time is 15:30 and the 1 day interval is selected, the printer will print the system status at 15:30 every day.

6.5 Enabling/Disabling the Alarm Relays

Three sets of remote alarm contacts are provided by the Model 1535. Each set of contacts is programmable and can be wired for Normally Open or Normally Closed operation. Figure 6-3 illustrates the remote alarm and interface module terminal strip located on the back panel of the 1535.

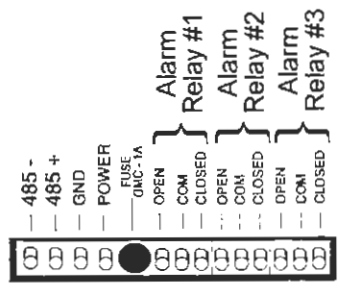


Figure 6-3
RS-485 Module Connector

All system alarms will activate Relay #1 only. System alarms include printer error, LCD (display) error, and FDD (optional floppy disk drive) errors.

Alarm outputs can be directed to any one of these remote alarm relays. This allows alarm outputs to be grouped into zones or directed to other warning devices. Each alarm relay contains a master setting that can deactivate that particular relay. Follow Chart 6-4 to disable/enable the master settings for remote relays 1-3.

6.6 Changing the Access Code

When manufactured, the Access (Security) Code for the Model 1535 is set at 0 0 0 0 (four zeros). When using the control panel to program or change settings, the microprocessor will not ask that the Access Code be entered if the code is four zeros. The screen will be by-passed.

To restrict the use of the Monitor/Alarm or to safeguard its information, the Access Code may be made active and changed at any time. Follow the instructions in Chart 6-5 to change the Access Code.

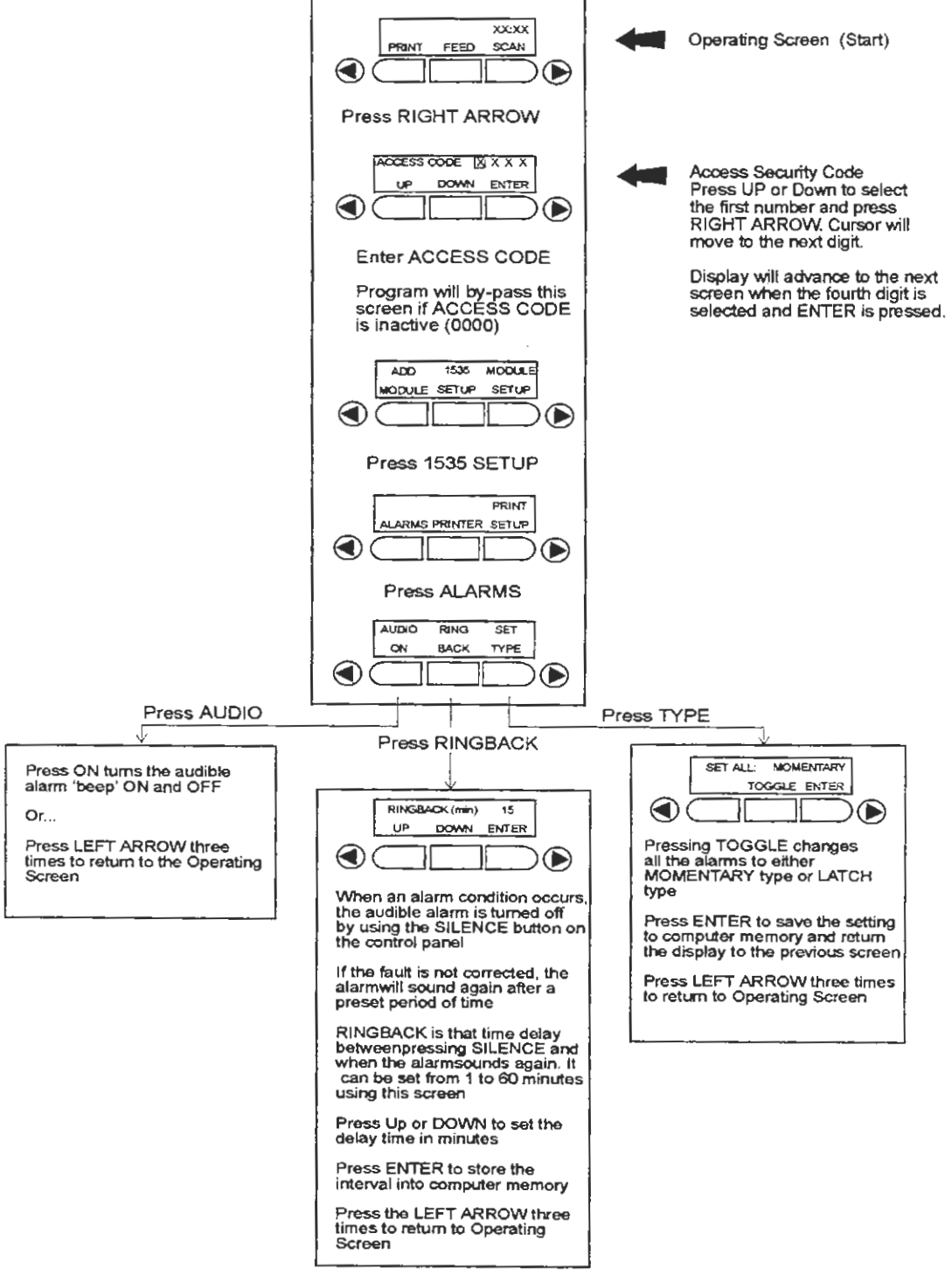
Should the new Access Code be forgotten, contact the Thermo Forma Service Department, toll-free 1-888-213-1790.

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Setting the Alarms

Chart 6-2

1535

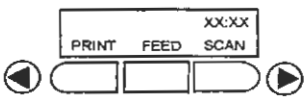


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Setting Printer Parameters

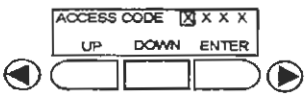
Chart 6-3

1535



Operating Screen (Start)

Press RIGHT ARROW

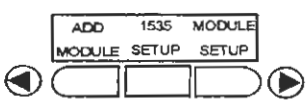


Access Security Code
Press UP or Down to select the first number and press RIGHT ARROW. Cursor will move to the next digit.

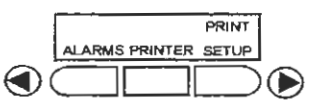
Display will advance to the next screen when the fourth digit is selected and ENTER is pressed.

Enter ACCESS CODE

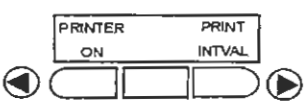
Program will by-pass this screen if ACCESS CODE is inactive (0000)



Press 1535 SETUP



Press PRINTER

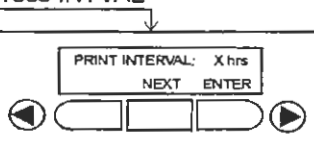


Press PRINTER

Press PRINTER to toggle the printer ON and OFF

Press LEFT ARROW three times to return to the Operating Screen

Press INTVAL



Press NEXT to scroll through intervals from once per minute to once per day

Press ENTER to select

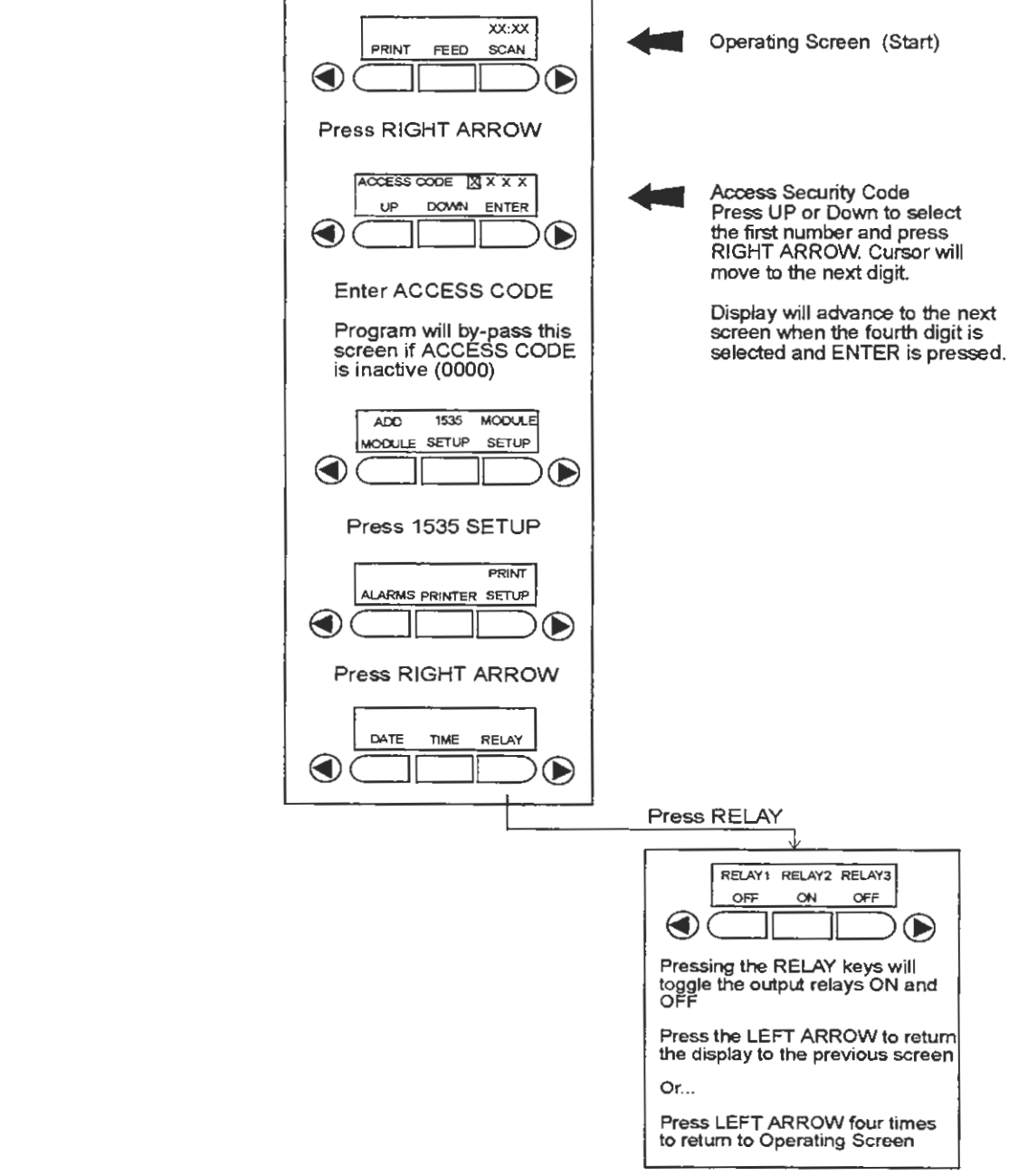
Press LEFT ARROW three times to return to Operating Screen

**If more than 25 items are to be printed, the minimum print interval is once every 5 minutes*

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Master Relay Settings

Chart 6-4
1535

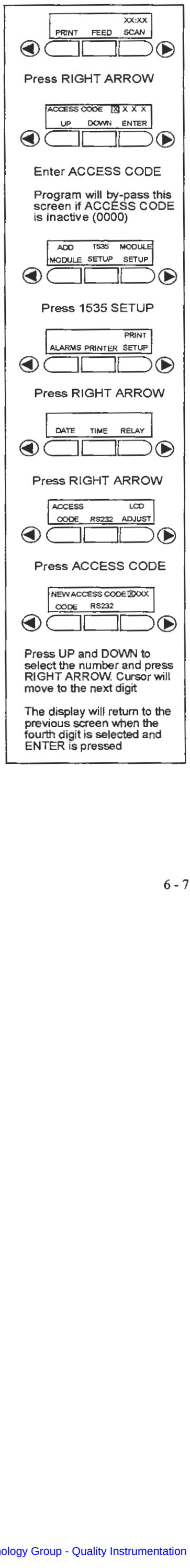


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Changing the Access Code

Chart 6-5

1535



Operating Screen (Start)

Access Security Code
Press UP or Down to select the first number and press RIGHT ARROW. Cursor will move to the next digit.

Display will advance to the next screen when the fourth digit is selected and ENTER is pressed.

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6.7 Configuring the RS-232 Port

a. General

Note: Units equipped with the optional Floppy Disk Drive do not have the RS-232 communications port.

The Model 1535 Alarm/Monitor is equipped with a RS-232 communication port for remote transmission of data. The connector is located on the rear panel of the 1535 as shown in Figure 6-4. The output data through the RS-232 port may be dumped to either a computer or a printer equipped for RS-232 communications.

The three wires indicated below are used on the DB-25 connector:

1. Transmit data (/TXD) pin 2
2. Receive data (/RXD) pin 3
3. Signal ground (GND) pin 7

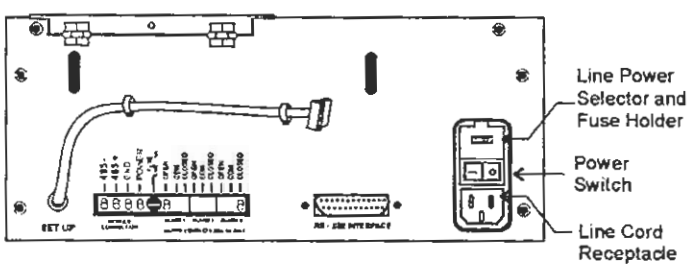


Figure 6-4
Rear Panel of the Monitor/Alarm Cabinet

The communication parameters are:

Baud rate	9600
Data bits	8
Start bits	1
Stop bits	1
Parity	none

The following parameters can be user-configured to produce the desired RS-232 format - communication interval, type of data format, column width, and page length.

b. Enabling/Disabling the RS-232 port

Follow Chart 6-6 to enable/disable the RS-232 port. Press the RS232 key to toggle the RS-232 port ON and OFF.

RS-232 ON: The RS-232 port automatically communicates the system status at the scheduled intervals and alarm occurrences

RS-232 OFF: No RS-232 communication at the scheduled intervals or alarm occurrences

c. Setting the RS-232 Communication Interval

Follow Chart 6-6 to set the desired RS-232 communication interval. Press the NEXT key to cycle through the available interval settings. When the desired interval is shown in the display, press the ENTER key to store the new interval to memory. The hour and day intervals begin when the ENTER key is pressed. For example, if the time is 15:30 and the 1 day interval is selected, the RS-232 communication will occur at 15:30 every day.

d. Selecting the Data Format

Follow Chart 6-6 to set the desired RS-232 data format (TYPE). Press the TYPE key to toggle between LINE and TABLE format. The following illustrates the RS-232 LINE and TABLE formats:

Line Format

```
103094 (Date)  2300 (Time)                    (CR)(LF)(EOT)
1: 37.0 C      5.0% CO2 NORMAL State          (CR)(LF)(EOT)
2: 36.8C       4.9% CO2 NORMAL State          (CR)(LF)(EOT)
```

Table Format

		1a	1b	1e	2a	3a	
Date	Time	C	%CO_2	State	C	C	(CR)(LF)(EOT)
103094	2300	37.0	5.0	NORMAL	36.8	37.1	(CR)(LF)(EOT)

e. Setting the Page Width

Follow Chart 6-6 to set the desired page width. Press the UP/DOWN keys to change the displayed value. When the desired setting is shown in the display, press the ENTER key to store the new width to memory. For best results, the width should be equal to the printer width to which the 1535 is attached.

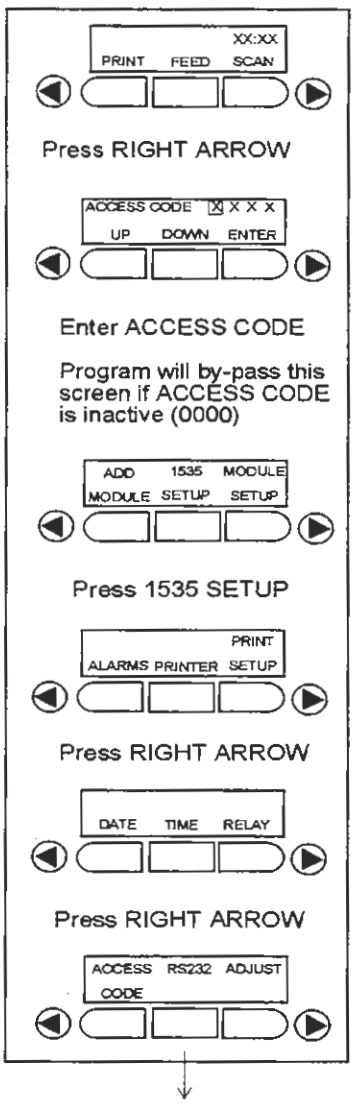
f. Setting the Page Length

Follow Chart 6-6 to set the desired page length. Press the UP/DOWN keys to change the displayed value. When the desired setting is shown in the display, press the ENTER key to store the new length to memory. For best results, the length should be equal to the printer page length to which the 1535 is attached.

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Programming the RS232 Port

Chart 6-6
1535



Operating Screen (Start)

Access Security Code
Press UP or Down to select the first number and press RIGHT ARROW. Cursor will move to the next digit.

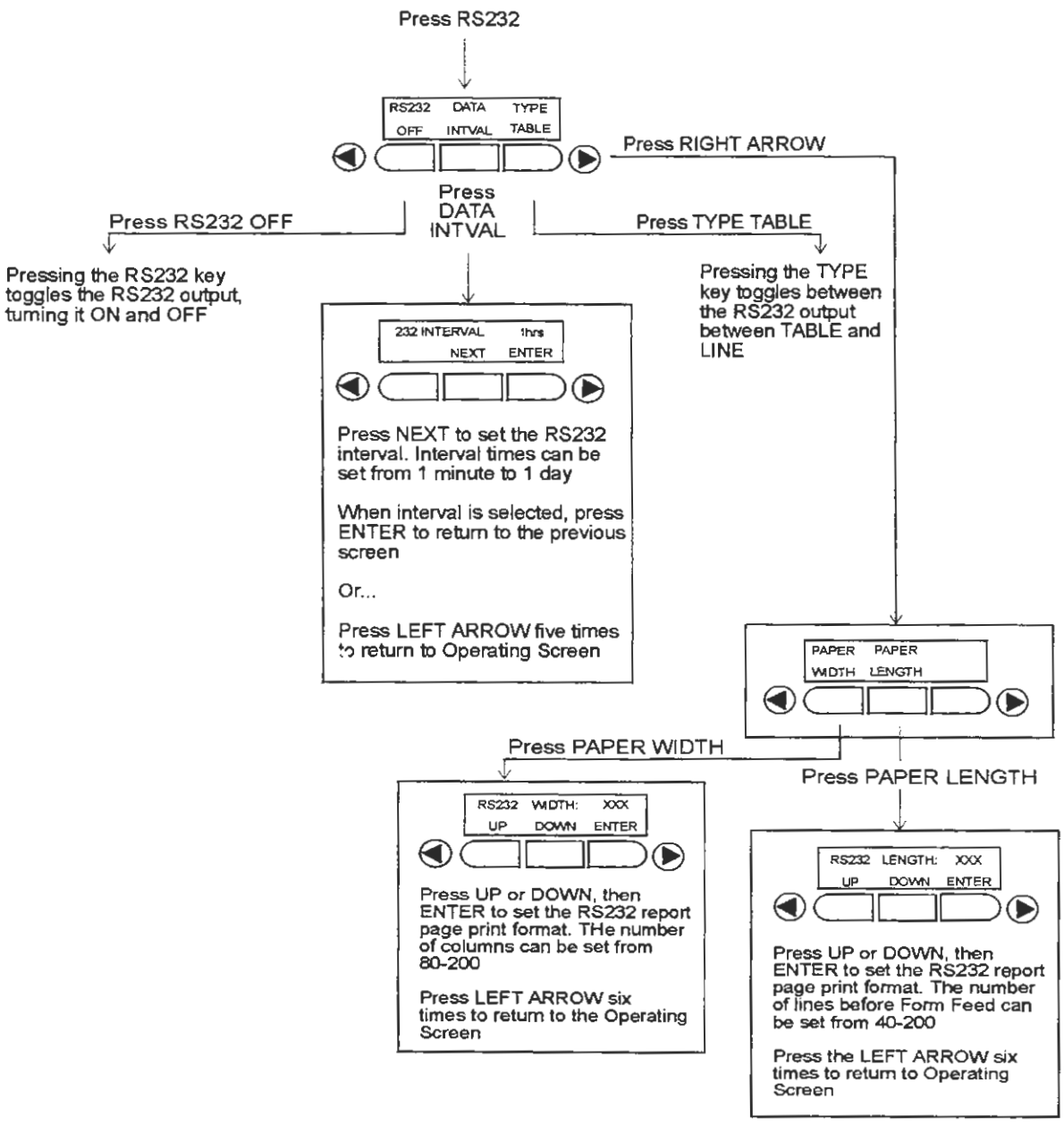
Display will advance to the next screen when the fourth digit is selected and ENTER is pressed.

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Programming the RS232 Port (continued)

Chart 6-6

1535



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Section 7 - Normal Operation

7.1 Scanning the System

The Model 1535 is always monitoring the system. Even when the unit is being used to program a module or change an alarm setting, the unit's priority is to scan and monitor the system. Because the 1535 is operating in the background, there may be a slight delay when control panel keys are pressed.

The printer is the source of total system information. All set-up data, module connections, temperature limits, alarm relay contact states, value labels, remote alarm and RS232 port assignments can be directed to the printer. System status reports can be produced by the printer at intervals from once per minute to once per 24-hours.

This information can also be directed to a separate dot matrix printer, creating reports on standard or extra wide carriage printers.

To alert the operator of an alarm condition, one that is either current or in the past and has since reset, the printer will record the details of the alarm state and print it in red.

7.2 Interpreting the Printer Information

a. The Header

The words "Thermo Forma" are printed above the time/date stamp only when the unit is first turned on or after a system reset.

Figure 7-1 shows the following:

1. The unit was turned on or reset at 8:07 a.m., October 20, 1994.
2. There are two RTD modules connected to the system on Channel 1 and Channel 2.
3. Both modules have temperature probes (Field A on both modules) and both are sensing temperatures within the set high and low temperature limits. Printing is in black.
4. Both modules have relay contacts connected, normally open/normally closed (Field B on both modules). Neither relay is in the alarm state and are showing NORMAL.
5. Module 2 has had labels assigned to the field values. C has been assigned to Field 1 to designate that the temperature is °C. State has been assigned to the relay contacts. When the labels were assigned, they replaced the words "RTD a" and "RTD b".

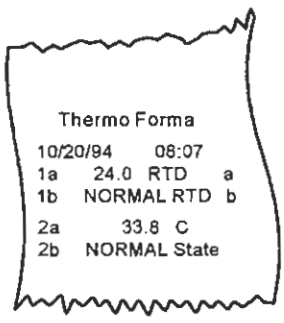


Figure 7-1

b. Going into the High Alarm State

When the temperature probe senses that the High Temp set-point has been exceeded, the unit alarm will sound, the alarm light will flash and the printer will record the information shown in Figure 7-2.

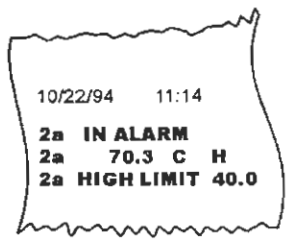


Figure 7-2

While the time and date stamp are printed in black, the alarm conditions are printed with the red ribbon.

Shown in the illustration, the first line notes that Module 2, Field a went into High Limit alarm state at 11:14 on October 22, 1994. This is noted by the capital "H" at the far right of the alarm information line. The temperature at that time was 70.3°C. The second line records that the High Limit temperature setpoint was 40.0.

c. Coming out of the High Alarm State

Figure 7-3 illustrates that the temperature returned within the alarm limits at 1:40 p.m. that same day. Present temperature is 28.7°C. This information is also printed in red even though the alarm condition no longer exists.

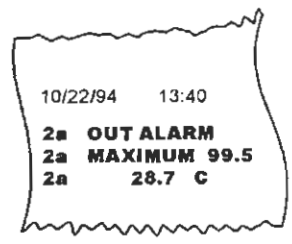


Figure 7-3

Also shown is that the maximum temperature reached during the alarm state was 99.5.

d. Going into a Low Alarm State

Similar information is printed when the temperature inside the monitored laboratory unit goes below the Low Temperature set-point.

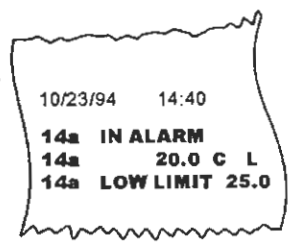


Figure 7-4

As illustrated in Figure 7-4 and printed in red, the temperature being monitored by Module 14, Field a, fell below the Low Limit set-point of 25.0°C at 2:40 p.m. on October 23rd. The capital L notes the Low Limit.

Also shown is the current temperature of 20.0°C.

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e. Coming out of Low Alarm

Continuing with the above example, Figure 7-5 shows that the temperature reported by Module 14 rose above the 25.0 low limit set-point at 3:35 p.m. that same day. (The current temperature is 28.7°C.)

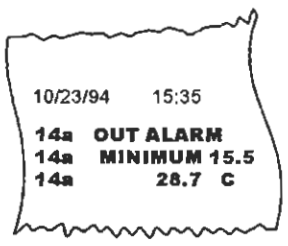


Figure 7-5

It also shows that during the alarm condition the temperature reached its lowest level of 15.5.

f. Alarm Contacts entering an Alarm State

As noted in Section 3.5, the RTD temperature module provides both temperature monitoring and a set of alarm contacts.

As frequently occurs, a low temperature alarm condition is the result of power interruption to the refrigerated unit, such as a circuit breaker or accidentally turning off the switch.

The high temperature alarm would not alert the operator until the internal temperature reached the high alarm set-point. The remote alarm contacts will realize a loss of electrical power immediately and initiate the alarm.

A typical alarm contact is illustrated in Figure 7-6. On October 26th, at 2:10 in the morning, the alarm contact on Module 2, Field b, went into the alarm state. This, too, is printed in red to alert the operator reviewing the paper tape. The capital "A" notes the alarm state.

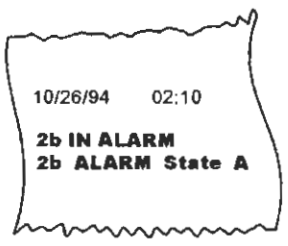


Figure 7-6

g. Alarm Contacts returning to the Normal State

Restoring power to the unit is also recorded by the Model 1535 and reported on the paper tape by the printer (in red).

Figure 7-7 illustrates the message that power was restored to Module 2's unit 20 minutes later.

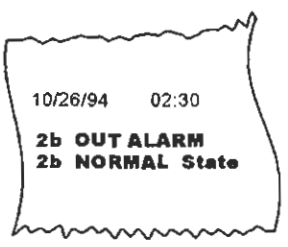


Figure 7-7

h. RS-485 Communication Errors

Communication failures result when the 1535 cannot communicate with a module. When this happens, normal values are set to 999.8 and the contacts are set to the Alarm state. (See the figures below and Troubleshooting, Section 8.6.b of this manual.)

The alarm information is printed in red by the printer and a capital "E" notes the RS-485 error. Because of their importance, RS-485 errors are logged by the printer even when alarms are disabled.



Figure 7-8
Contacts



Figure 7-9
Values

i. Returning from an RS-485 Communications Error

When communications to the module return, the Normal message is printed in red. No error code (E) is printed on the right showing that everything is back to normal. (Figures 7-10 and 7-11)

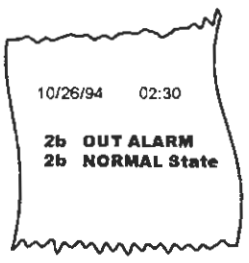


Figure 7-10
Contacts

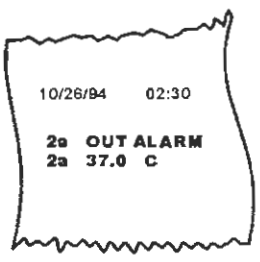


Figure 7-11
Values

7.3 Alarms

The liquid crystal display alerts the operator of an alarm condition.

Alarms can be programmed to respond in two ways: momentary or latched. A momentary alarm will clear and reset itself when the alarm condition ceases. The printer will record, time and date stamp the alarm in red and the red alarm warning light will flash. The audible "beep" will sound and can be silenced with the Silence button on the control panel.

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The Latching alarm will activate the red flashing light and audible "beep" but will not clear until the alarm condition is corrected at the source. The control panel will display the alarm by showing the channel/field, with the Alarm Message and the word INFO (Figure 7-12). Pressing INFO displays the condition causing the alarm (Figure 7-13)

To clear the message from the display, correct the alarm condition, then clear the display by pressing CLR as shown in Figure 7-14. CLR only appears for Latching alarms.

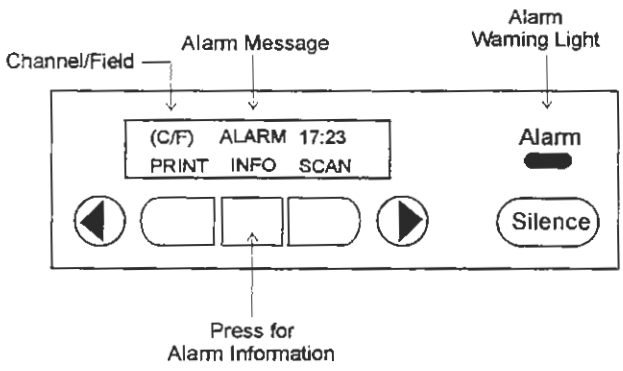


Figure 7-12
Control Panel displaying an Alarm warning (Error Screen)

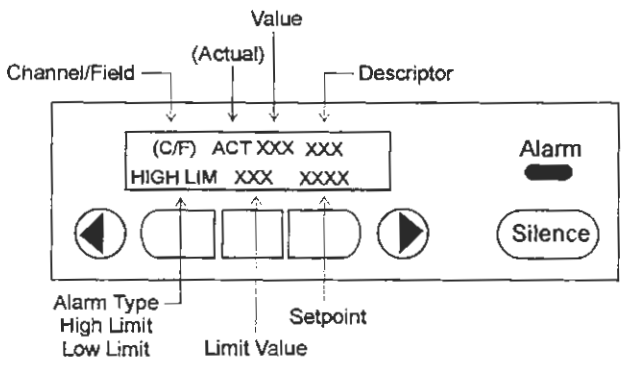


Figure 7-13
Control Panel Showing the Alarm Information

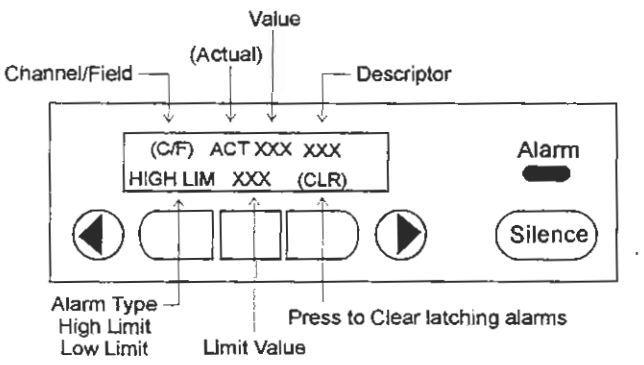
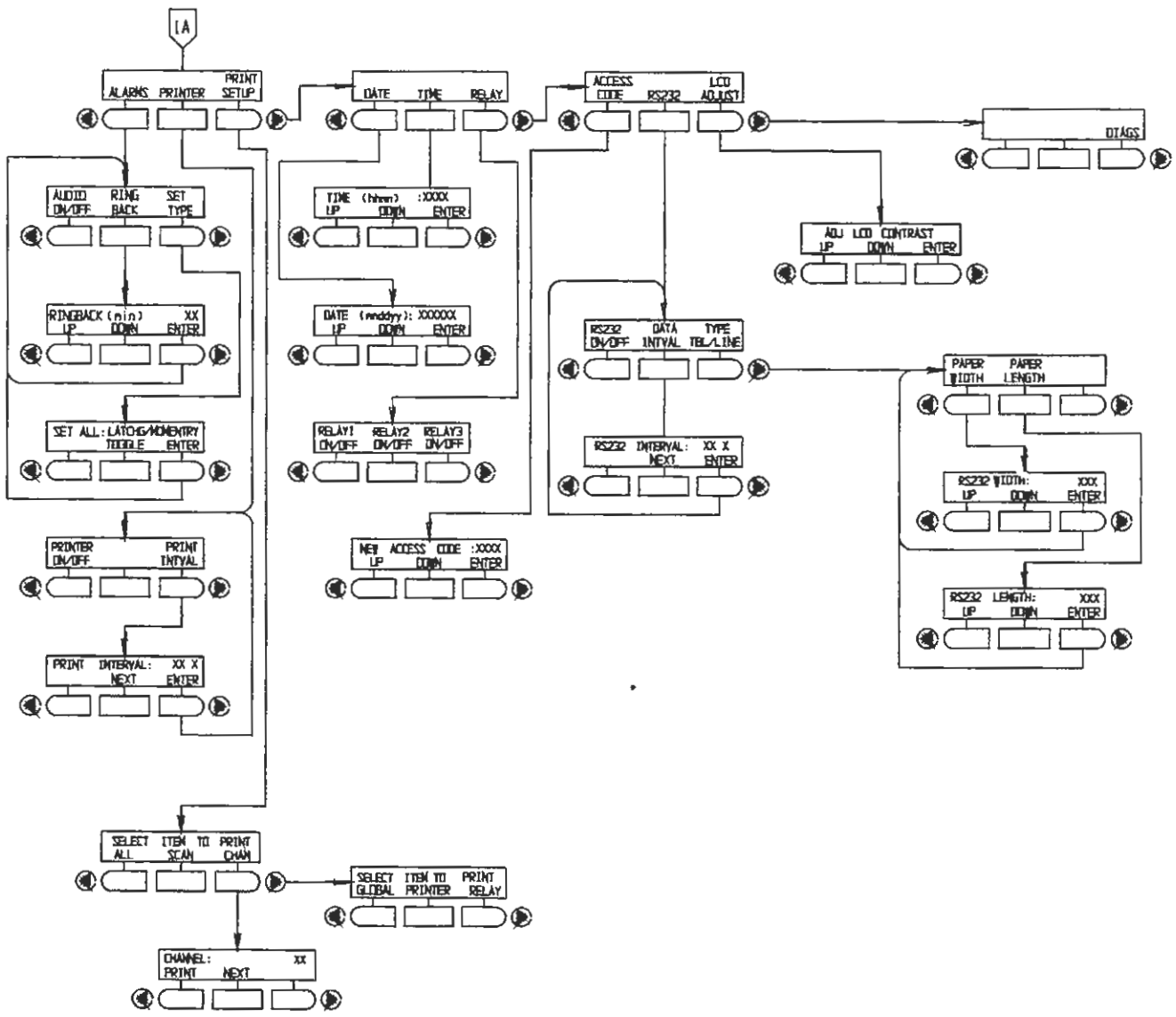


Figure 7-14
Clearing a Latching Alarm

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1535 MENU FLOW DIAGRAMS

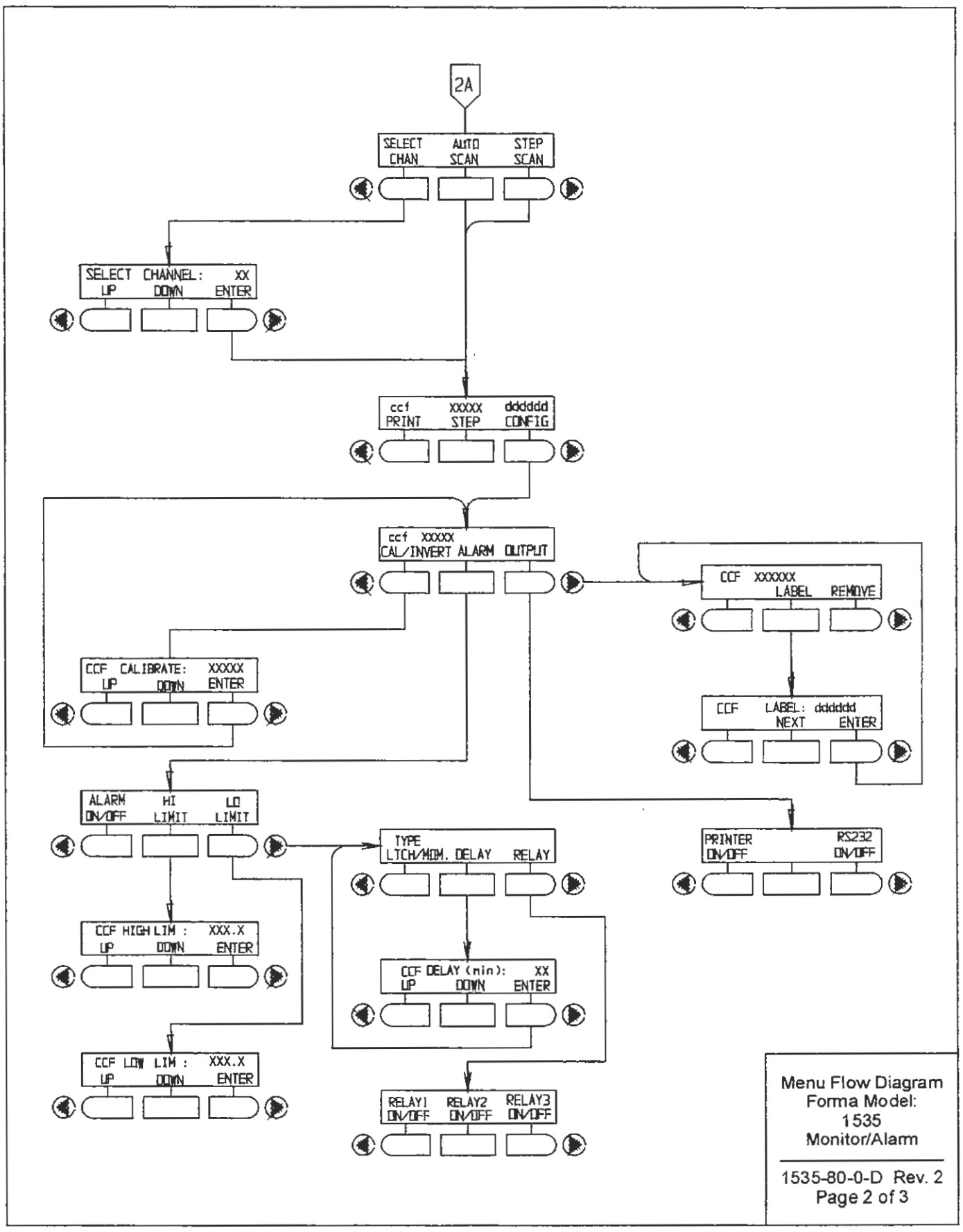
SOFTWARE VERSION 1.0



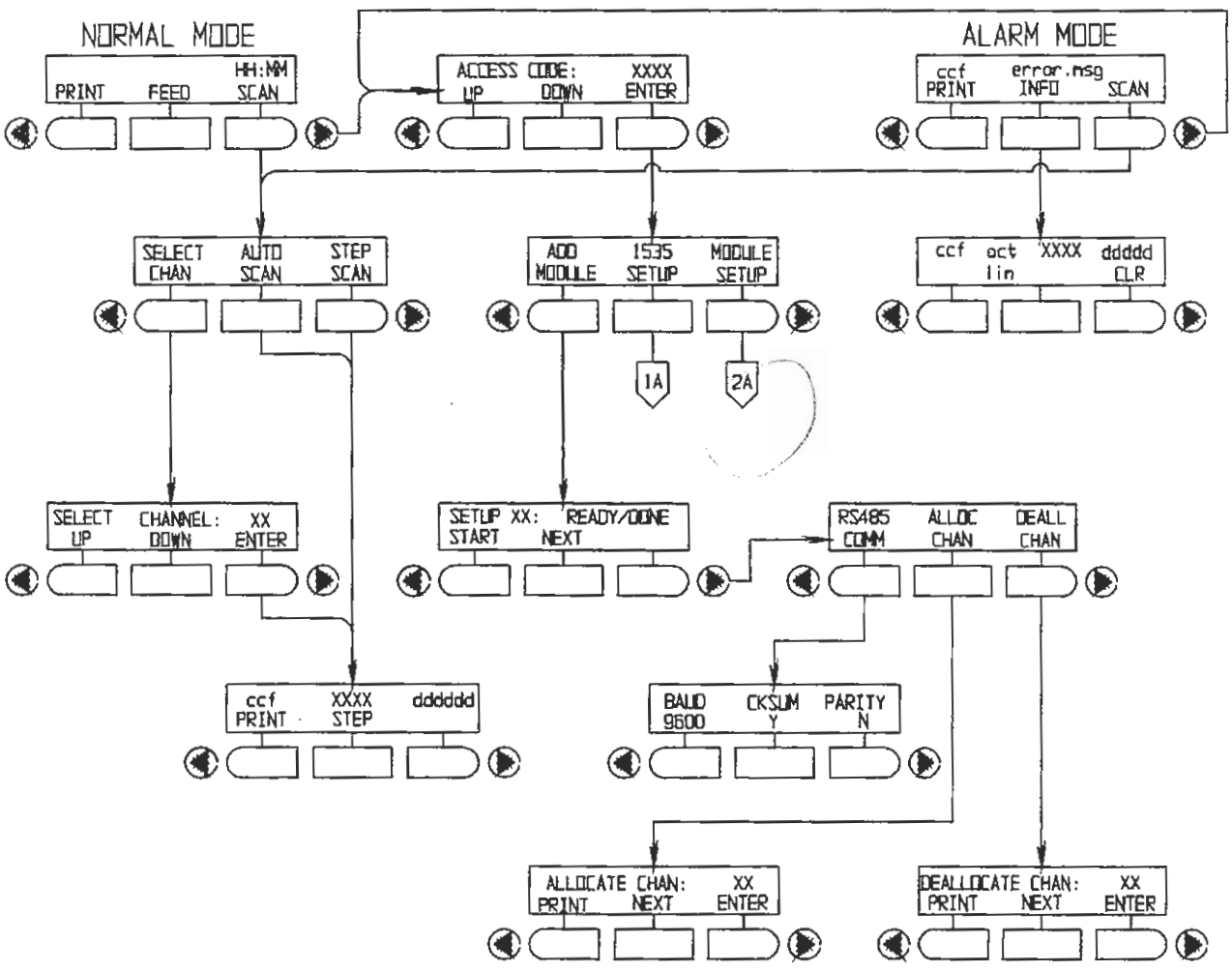
Menu Flow Diagram
Forma Model:
1535
Monitor/Alarm

1535-80-0-D Rev. 2
Page 1 of 3

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Forma Scientific

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
2	AS-95	01-19-95	MAH	PDK	LDN	REVISED MENU FLOW DIAGRAM
1	AS-90	11-02-94	DB	DB	LDN	CHG'D RS232 DATA BOYL MENUE
0	N/A	10-27-94	DB	DB	MH	RELEASED FOR PRODUCTION

DATE 10-27-94	DWN DALE	CAD DCB	APPD MH	SCALE N/A	
CUSTOMER					
JOB TITLE	1535 MONITOR/ALARM				
DWG TITLE	MENU FLOW DIAGRAM				
LOCATION ALARMSOI	JOB NUMBER	DRAWING NUMBER 1535-80-0-D			

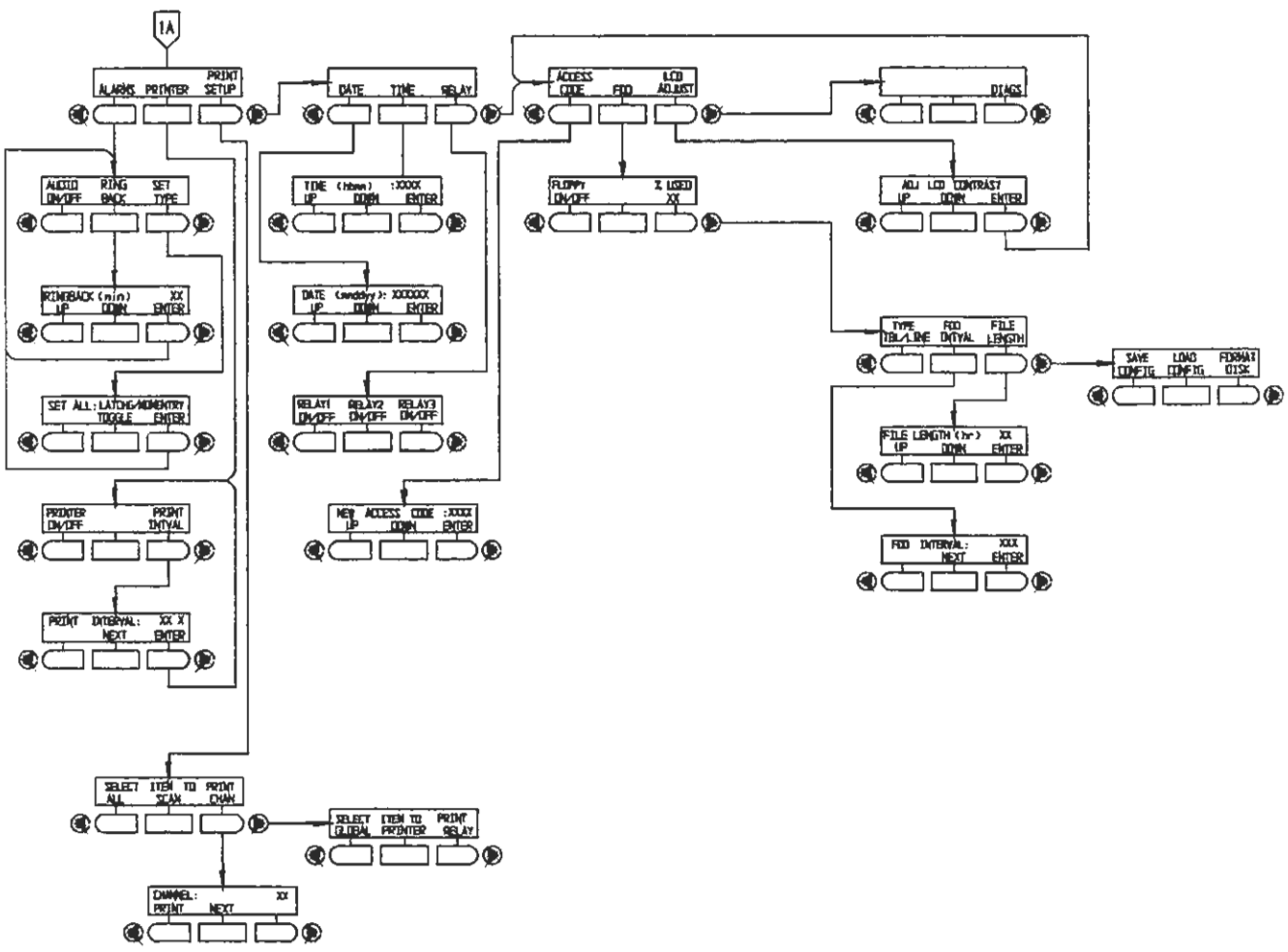
Menu Flow Diagram
Forma Model:
1535
Monitor/Alarm

1535-80-0-D Rev. 2
Page 3 of 3

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1535 MENU FLOW DIAGRAMS WITH FDD

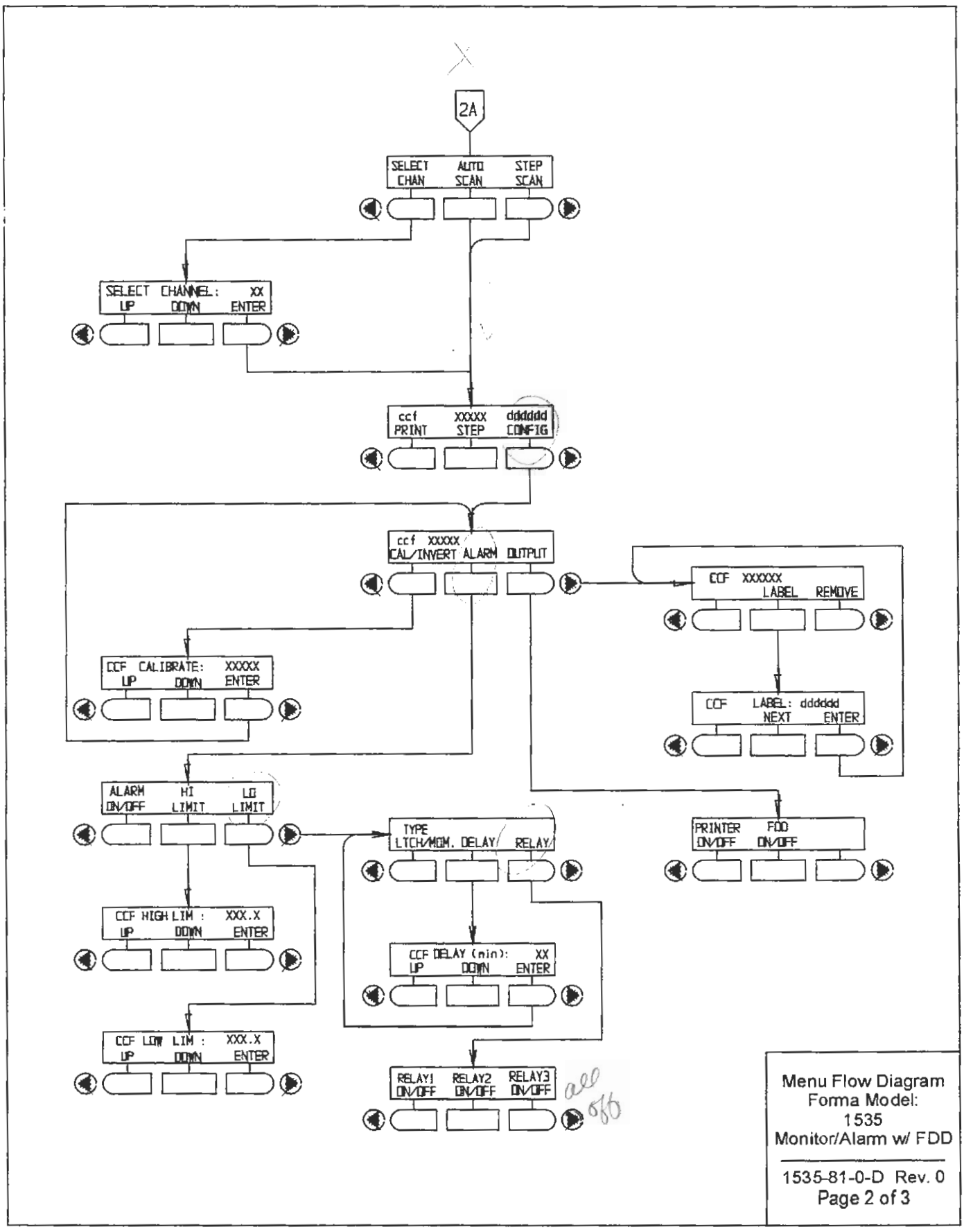
SOFTWARE VERSION 2.0



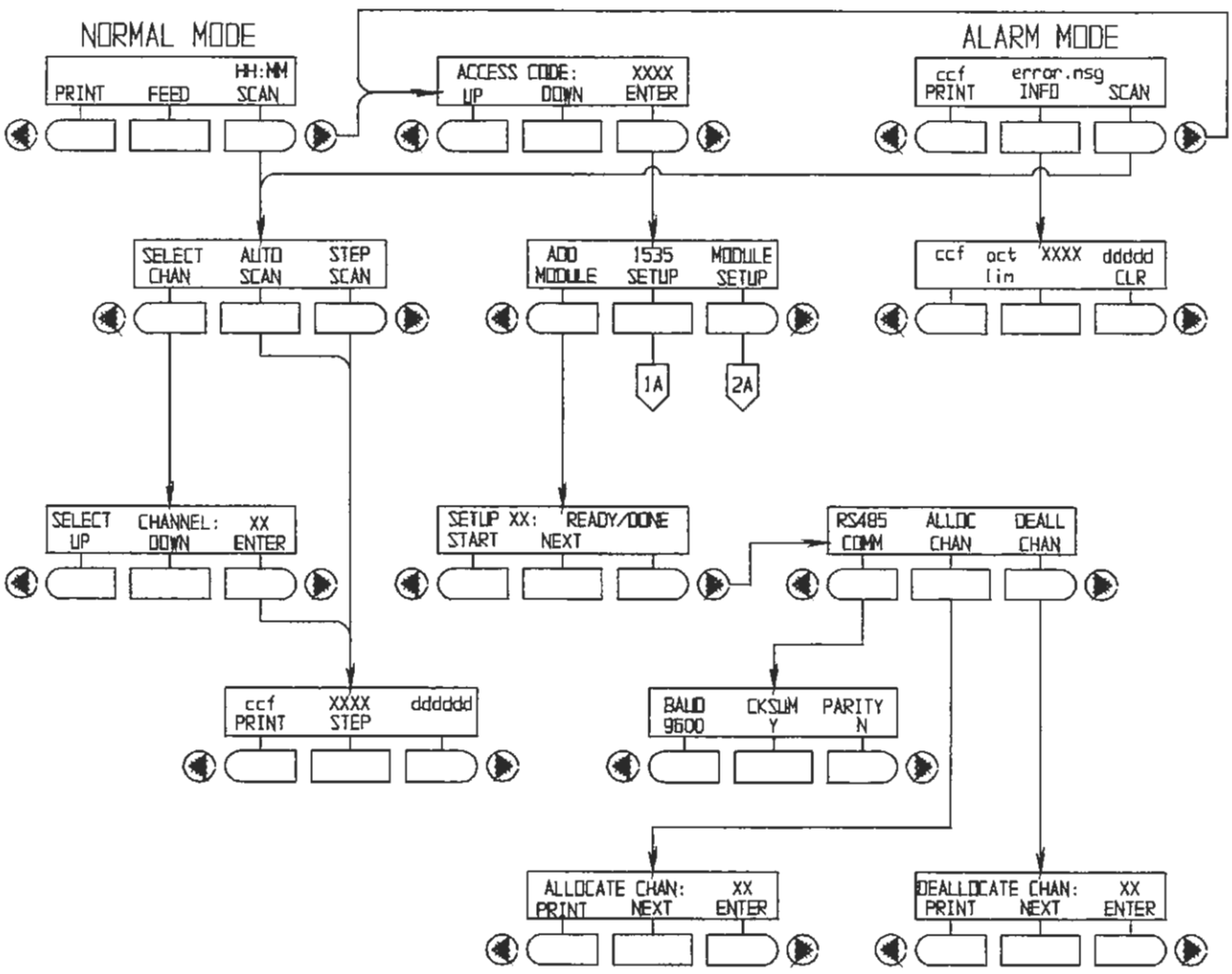
Menu Flow Diagram
Forma Model:
1535
Monitor/Alarm w/ FDD

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REV	ECN NO	DATE	BY	CAD/APPD	DESCRIPTION OF REVISION
0	N/A	12/08/94	DB	DB LON	RELEASED FOR PRODUCTION

DATE 12/08/94	DWN DALE	CAD DOB	APPD LON
CUSTOMER			
JOB TITLE	1535 MONITOR/ALARM WITH FDD		
DWG TITLE	MENU FLOW DIAGRAM		
LOCATION	JOB NUMBER	DRAWING NUMBER 1535-81-0-D	

Forma Scientific

Menu Flow Diagram
Forma Model:
1535
Monitor/Alarm w/ FDD

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Section 8 - Maintenance

8.1 General Cleaning

a. Cabinet

The powder-coated steel cabinet surfaces can be cleaned with common laboratory materials. However, liquids should not be allowed to enter the cabinet. All spills should be cleaned up immediately.

b. Control Panel

The microprocessor control panel uses sealed push buttons and a liquid crystal display. The control panel can be carefully cleaned with a laboratory detergent and dried with a soft cloth.

Windex™ cleaning materials should not be used on the Monitor/Alarm control panel.

8.2 Alarms and Alarm Conditions

If the microprocessor control system senses a fault, malfunction, or abnormal operating condition, alarm messages will appear on the liquid crystal display. These messages will be helpful should service or repair assistance be necessary.

8.3 Changing the Printer Paper (P/N 197019)

Access to the built-in dot matrix printer is made by raising the metal cover on the top of the Alarm/Monitor cabinet. Do not raise the cover by inserting the fingers into the paper exit slot. Very sharp serrations are located in this slot which may cause cuts and abrasions. Raise the cover instead by inserting a fingernail or fingertip into the leading edge of the cover.

Do not raise the printer cover by inserting fingertips into the paper exit slot. A sharp serrated edge is located in the slot which is used to tear the paper and could cause cuts or abrasions.

The print head may be very hot. Avoid touching it when changing the paper.

The Alarm Monitor printer uses rolled paper which is fed from a spool located on the printer cover. When replacing the paper, attach the roll onto the spool holder so that the paper feeds over the back of the roll and downward. Insert the end of the paper into the slot on the back of the printer carrier as shown in Figure 8-1. An embossed arrow is located on the metal feed tray to assist in finding the feed slot.

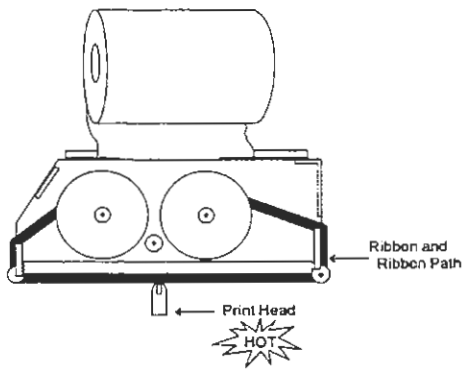


Figure 8-1

Press the FEED button (the center button when viewing the Operating Screen) while inserting the end of the paper roll into the feed slot. A single press of the Feed button will extend about 2 inches of paper.

Make sure the paper extends past the print head and ribbon.

Pass the paper from the printer through the serrated slot. Close the printer cover when the paper path is complete.

8.4 Changing the Printer Ribbon (P/N 197066)

When changing the printer ribbon, avoid touching the print head if the printer has been operating. Very high temperatures are generated in the print head which will cause burns if touched.

1. Refer to the illustration, Figure 8-1, and note the ribbon path.
2. Lift the two ribbon spools from their spindles and remove the ribbon from the front of the print head.
3. Install the new ribbon with the black strip on top.
4. Insert the spools onto the spindles, making sure the ribbon is in front of the print head.
5. Feed the paper through the serrated slot and close the printer cover.

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8.5 Changing the Power Voltage Setting

1. Using the small flat blade screwdriver supplied with the unit, open the hinged cover as shown in Figure 8-2.
2. Remove the fuse holder, replace the fuses with the appropriate size and rotate it 180°. Refer to the fuse specifications chart in Table 8-1.
3. Replace the fuse holder into its receptacle and close the hinged cover. The proper operating line voltage must be visible in the small window.

a. Fuses

The electrical fuses installed in the voltage selector/fuse holder are the main fuses for the Monitor/Alarm. The fuse ratings are listed in Table 8-1.

Voltage Selected	Fuse: 5x20mm, 250v UL 198G Time - Lag
115 Volts	800 mA
230 Volts	400 mA

Table 8-1
Fuse Specifications

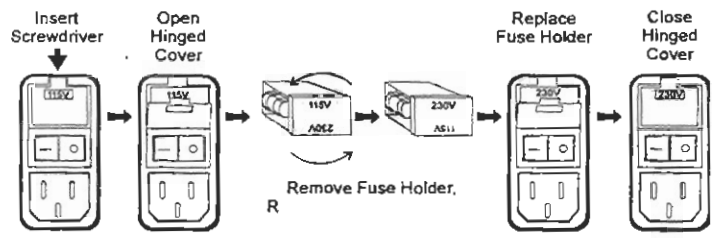


Figure 8-2
Changing the Line Power Voltage Selector

8.6 Troubleshooting the Model 1535

a. Running the System Diagnostic Programs

Several built-in test functions are programmed into the 1535. However, they should only be used by qualified personnel or at the direction of Thermo Forma Service Department.

b. Special Error Displays

There are three "999" error messages which can be directed to the display:

1. A 999.9 signifies that a problem has occurred between the module and the equipment being monitored
   - RTD Module - the probe has been disconnected or has failed
   - Analog Module – the ϕ - 1 volt input is greater than 1 volt.
   - RS-232 - Not communicating with the equipment being monitored.
2. A 999.8 signifies that the connection between the module and the 1535 has been broken.
3. A 999.7 signifies that a calibration offset is set too large.

c. Module Power Fuse

Errors in the alarm network wiring can cause the module power fuse to blow. If all the green power lights on the modules are OFF, the power fuse has probably blown. The fuse is located on the rear panel of the 1535 (Figure 8-3). This fuse is a 5 x 20 mm, 1A time-delay fuse. To change the fuse, use the 1535 screwdriver to press and turn the fuse cap a 1/4 turn to remove the existing fuse. Replace the fuse with a new one of the same size and rating. Insert the new fuse, then press and turn the cap 1/4 turn clockwise.

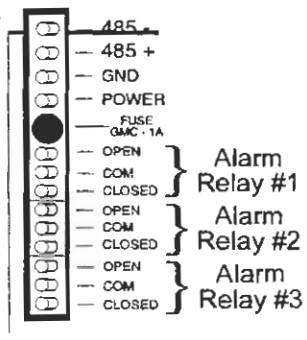


Figure 8-3
(Shown vertically for illustration purposes)

8.7 Adjusting the Contrast of the Liquid Crystal Display

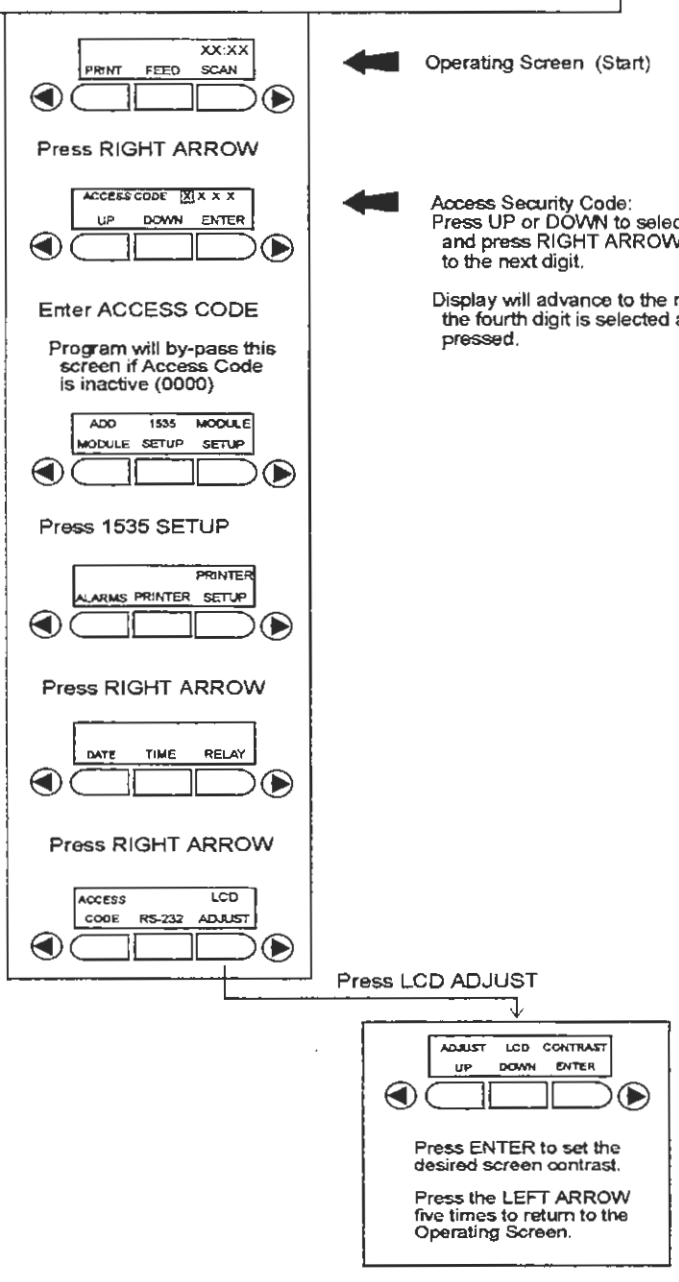
The 1535 Liquid Crystal Display can be adjusted to accommodate a wide variety of laboratory lighting conditions. Refer to the instructions in Chart 8-1.

Use caution when altering the contrast of the Liquid Crystal Display. If the light level of the display is set at its lowest level and the Enter button pressed, the display may be too dim to be seen.

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LCD Adjustment System Diagnostics

Chart 8-1
1535



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Section 9 - Specifications

Communications:

- Communications in ASCII via RS-485 ports
- Communications distance up to 2000 feet of total cable
- Monitors a maximum of 6 data inputs from 24 channels
- Scan rate of 2 channels per second
- Communications error checking via checksum
- Baud rate: 9600
- NRZ asynchronous data format
  1 start, 8 data, and 1 stop bit
- Parity: none
- All communication setups retained during a power loss

Alarm Outputs:

- Audible and visual alarm annunciation
- HI/LO limit checking with a user selectable delay time
- Alarms: User selectable latching or momentary
  latching (stays on if input returns to within limits)
  momentary (turns off if input returns to within limits)
- 3 sets of NO/NC alarm contacts with user selectable zoning

Recording:

Printer	Serial unpact dot matrix Black and red printing
Paper	2.25 inch width
Print Interval	1 minute to 24 hours
Recorded Data	Date, time, channel #, channel input, input designator and alarm conditions
Data Output	RS-232 interface standard to store data to an external printer

Clock Accuracy:

0.004% @ 25°C (±3.5 sec/24 hours)
0.006% @ 5°C to 40°C (±5.2 sec/24 hours)

User Interface:

Six button membrane switch panel with a 2 line by 20 character LCD display

Construction:

Finish Powder coated, antique white with slate blue trim.
Salt spray test exceeds 1,000 hours per ASTM standard B117-85.

Electrical:

1535 90-125 VAC 50/60 Hz, 1PH, 0.6 FLA
180-250 VAC 50/60 Hz, 1PH, 0.3 FLA

Modules

RS-232	10 mA normal, 80 mA peak @ 8-26 VDC input
RTD	15 mA normal, 30 mA peak @ 8-26 VDC input
Analog	15 mA normal, 30 mA peak @ 8-26 VDC input
Power Inlet Cord	8' (2.4m) with IEC 320 female plug (cabinet interconnect) and country-specific plug

Certification:

North American versions of IEC 1010:
C.S.A. Standard C22.2 No. 1010.1-92
U.L. Standard No. UL 3101-1

Dimensions:

Exterior (Model 1535)	14.0"W x 6.0"H x 13.5"F-B
Exterior (Modules)	4.1"W x 1.5"H x 6.5"F-B

Net Weight:

Model 1535	20 lbs.
Modules	1 lb.

Warranty:

1 year parts and labor

Power:

Remote Modules	24 Max
Voltage range	8-26VDC (15W Max) supplied by the 1535

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Environmental:

Thermo Forma Model 1535 is designed to operate in the following environmental conditions:

- Indoors
- Altitude - 2,000 meters
- Temperature - 5°C to 40°C
- Humidity - 80% RH at or below 31°C, decreasing linearly to 50% RH at 40°C
- Mains Supply Fluctuations - Operating Voltage Range
- Installation Category II[1]
- Pollution Degree 2[2]
- Class of Equipment I

[1] Installation Category (overvoltage category) defines the level of transient overvoltage which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II which is the category used for instruments in installations supplied from a supply comparable to public mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500V for a 230V supply and 1500V for a 120V supply.

[2] Pollution Degree describes the amount of conductive pollution present in the operating environment. Pollution Degree 2 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivy caused by condensation.

Options:

Stock# 190477: Floppy disk drive for time-stamped data and alarm storage (3.5 inch 1.44 Mbyte)

Accessories:

Stock# 190459: Analog to RS-485 Converter Module
Monitors 4 analog signals (0-1V) and 2 sets of dry contacts

Stock# 190458: RS-232 to RS-485 Converter Module
Monitors 1 RS-232 port and 1 set of dry contacts

Stock# 190457: RTD temperature probe to RS-485 Converter Module
Narrow range RTD; -90°C to +70°C
Monitors an RTD temp. probe and 1 set of dry contacts

Stock# 190456: RTD temp. probe to RS-485 Converter Module
Wide range RTD; -200°C to +70°C
Monitors an RTD temp. probe and 1 set of dry contacts

Stock# 400047: Sensaphone for telephone hookup

Stock# 430222: 4 wire cable for power and signal transmission

Stock# 190470: Wall mounting bracket for 1535

Stock# 270078: UPS for nominal 120V, 60Hz (Uninterruptable Power Supply)

Stock# 197063: 4 ft. cable for use with analog modules

Stock# 270082: UPS for nominal 220V, 50Hz (Uninterruptable Power Supply)

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Section 10 - Spare Parts

Model 1535 Monitor/Alarm

Part No.	Description
29760	Adding machine Tape 2-1/4"
190439	Wired display driver board
190446	Wired 1535 micro board
190450	Printer interface board
197066	Printer ribbon, red/black
201080	Dot matrix printer
230135	Fuse, 1A, TD, 5x20mm (module power fuse)
230141	Fuse, 800 mA, T.D., 5 x 20 mm
230149	Fuse, 400 mA, T.D., 5 x 20 mm
320295	Bridge rectifier, 15A 50V
370342	4-pos. plug terminal block
370343	3-pos. plug terminal block
420087	130 VA transformer
430108	Cordset, 10A/125V
430221	1535 wiring harness
460154	Power entry module
430222	4-wire cable, 2-18 ga., 2-22 ga.(twisted pairs)

Wide range RTD Module (Part No. 190456)

Part No.	Description
190454	Wide range RTD probe w/ 6 ft. lead
190451	Telephone cord, 6 ft.
190392	Converter box, phone jack to screw terminals

Narrow range RTD Module (Part No. 190457)

Part No.	Description
190453	Narrow range RTD probe w/ 6 ft. lead
190451	Telephone cord, 6 ft.
190392	Converter box, phone jack to screw terminals

RS-232 Module (Part No. 190458):

Part No.	Description
190472	Converter box, DB-25 to phone jack
190451	Telephone cord, 6 ft.
190392	Converter box, phone jack to screw terminals
190525	Converter box, DB-9 (male) to phone jack
190526	Converter box, DB-9 (female) to phone jack
190527	telephone cord (6 conductor)

Analog Module (Part No. 190459):

Part No.	Description
197063	4 ft. shielded cable with audio jack
190451	Telephone cord, 6 ft.
190392	Converter box, phone jack to screw terminals

Interface to Thermo Forma Orbital Shakers

Part No.	Description
197067	6 ft. cable with connectors

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Section 11 - Options

11.1 Connecting the Uninterruptable Power Supply (270078 and 270082)

The Uninterruptable Power Supply is not rated for life-support applications.

The optional Uninterruptable Power Supply provides a back-up power source for the Model 1535. When the batteries are fully charged, the UPS provides approximately one hour of uninterrupted power during a power failure.

The UPS batteries are fully charged when the unit is connected to utility power for a minimum of four hours. The UPS power switch does not have to be on for the batteries to charge. When battery replacement becomes necessary, refer to the UPS user's manual.

a. Connecting the Uninterruptable Power Supply (P/N 270078, 115 volt, 50/60 Hz)

Plug the line cord from the Model 1535 into one of the receptacles on the back of the UPS and plug the UPS line cord into a suitable wall outlet.

Turn the UPS power switch on.

b. Connecting the Uninterruptable Power Supply (P/N 270082, 230 volt, 50 Hz)

An appropriate export line cord set and a coupler for connecting between the UPS and the Model 1535 are supplied. See Figure 11-1 below.

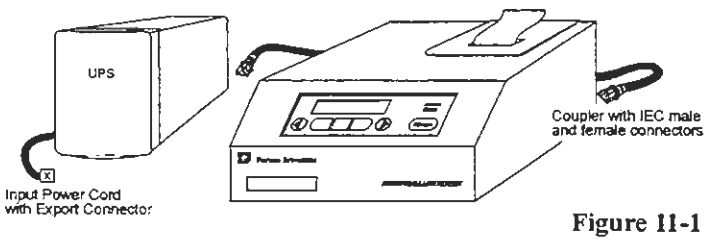


Figure 11-1

The Uninterruptible Power Supply contains potentially hazardous voltages even when not connected to line voltage.
Do not attempt to disassemble the unit. The unit contains no user-serviceable parts. Repairs must be performed by factory trained service personnel only.

11.2 Floppy Disk Drive Option (FDD, Part No. 190477) (Refer to Drawing 1535-81-0-D)

Units that are equipped with the factory-installed floppy disk drive do not have the RS-232 Serial Communications port. Disregard all reference in the manual to the RS-232 serial communications port.

a. Description

The 1535 floppy disk drive requires a formatted 1.44M High Density diskette for normal operation. The FDD performs two functions:

- Saves the complete system configuration of the 1535 (high/low limits, alarm delays, scan/print/relay/FDD lists, print and FDD intervals, and more) to the floppy for reloading into a 1535 at a later time.
- Logs monitored data to the floppy disk at user defined intervals and into files of user defined length. A disk will last over 30 days when storing 24 fields of data at 1 hour intervals.

The FDD may be customized to the user's need by style of data format, in either Line or Table formats. The rate, or interval, at which data is stored to the floppy can also be set by the user as well as the length of the file.

Data is stored to files using the following naming conventions:

DATA filename	YYMMDDHH.DAT (stores data only)
ALARM filename	YYMMDDHH.ALM (stores alarm information only)

The date and time when the file was created are represented as follows:

YY	last two digits of the calendar year	
MM	two digit month	(01-12)
DD	day of month	(01-31)
HH	hour of day	(00-23)

Thermo Forma recommends a backup power system when logging critical data. A power outage while writing to a disk may corrupt the data.

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b. Formatting a Diskette



Formatting a diskette permanently erases all previously stored data on the diskette The format process begins immediately upon pressing the FORMAT DISK key. Once the format process is started, it cannot be aborted.

Before beginning operation of the FDD, format a High Density 3-1/2 inch 1.44M disk. Insert the diskette in the drive and press the FORMAT DISK key to start the formatting. This process takes approximately 2-1/2 minutes. See Chart 11-1.

c. Saving and Loading the Configuration

To save or load (restore) the 1535 configuration, enter the 1535 SETUP screen. Refer to the FDD flow diagram 1535-81-0D, or Chart 11-1.

1. Press the right arrow key two times.
2. Press the FDD key.
3. Press the right arrow key two times.
4. With a formatted 1.44M High Density disk inserted in the drive, press the SAVE CONFIG key to store the complete system configuration to the disk. The 1535 configuration is saved to the file named F1535.CFG. The diskette should be stored in a safe place. This file can be loaded back to the 1535 at a later date.



Contact the Thermo Forma Service Department before loading a new configuration file. All existing configuration is permanently erased when the new configuration is loaded.

5. With a disk containing a previously saved configuration inserted in the drive, press the LOAD CONFIG to *restore* the system configuration. The 1535 will reset itself after a valid 1535 configuration file is loaded.

d. Customizing the Data Output (See Chart 11-2)

The rate at which data is stored to the floppy can be set in the FDD interval display (FDD INTVAL). The default interval is 1 hour.

1. Press NEXT to step through the available interval settings.
2. Press ENTER to save the desired setting.

Setting the Data Format Type and the File Length

The type of data format may be set to either the Line or Table format. The Table format is recommended for data graphing and spreadsheet applications requiring limited amounts of data. The Line format is recommended for larger amounts of data and may be printed on a standard page. The default style is the Line format.

An example of each type follows.

LINE TYPE (each module is logged on an individual 80 character line)

```
010194 1536                    (DATE: month day year  TIME: hour minute)
 1:    37.0 C  5.0 %CO2          (Module number is displayed on far left)
 .                .
 .                .
24:    36.9 C  4.9 %CO2  37.1 C  5.1  %O2  NORMAL state NORMAL state
```

TABLE TYPE (data is displayed in columns with headers)

```
                  1a    1b    24a   24b   24c  24d    24e    24f (module and field)
DATE   TIME    C %CO2  C %CO2  C %O2   state  state (descriptors)
010194  1536  37.0  5.0 36.9  4.9 37.1  5.1 NORMAL  NORMAL
```

Note: A table is limited to 96 columns of data

Selecting the data format type:

1. Select TYPE TABLE/LINE under the 1535 FDD SETUP.
2. The type key toggles between the TABLE and LINE formats. Select the desired format.

Setting the file length:

The length of each file can be set from 1 hour to 800 hours (33 days). The default is 24 hours. After the set amount of data is logged to the file, a new file is created.

1. Select FILE LENGTH to adjust the length up and down.
2. Press ENTER to save the desired setting.

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e. Directing Data to the FDD (See Chart 11-3)

Each field of data must be individually directed to the FDD output. To direct a field of data to the floppy disk:

1. Select the channel and field under MODULE SETUP.
2. Press the CONFIG key.
3. Press the OUTPUT key.
4. Press the FDD OFF key to toggle the setting to FDD ON.

Note: Repeat this for each field of data that is to be logged on the floppy disk.

To start or stop logging of the data:

1. Enter the 1535 SETUP mode.
2. Under the FDD key press the FLOPPY ON/OFF key to start or stop logging to the disk.



Always stop the disk logging before inserting or removing a diskette from the disk drive. Inserting or removing a diskette while the 1535 FDD is on, may corrupt data on the disk. Also, removing a diskette while the 1535 FDD is on, will cause a "Bad Disk" error which wil activate the 1535 Relay #1. Always make sure the disk drive light is out when inserting or removing a diskette.

f. Error Messages

The following FDD error messages may be displayed in the ALARM MODE display:

Disk XX% Full — This warning starts at 80%. Storage to the floppy disk continues until 100% is reached.

To clear the message, disable the FDD (FDD OFF), remove the diskette, insert a blank formatted high density diskette, and enable the FDD (FDD ON). In 1535 SETUP mode, the FDD %USED displays the percentage of the disk that has been used.

Bad Disk — This error message appears if no disk is present, the disk is write protected, the disk is full, or the root directory is full or if the disk is removed without turning the FDD off.

To clear the message, disable the FDD (FDD OFF), remove the diskette, check the diskette, insert a diskette and enable the FDD (FDD ON).

FDD Error — This error message appears if the floppy disk drive malfunctions.

To clear the message, disable the FDD (FDD OFF), and enable the FDD (FDD ON). Call for service if the error happens repeatedly.

Note: All FDD error messages activate 1535 RELAY #1 only.

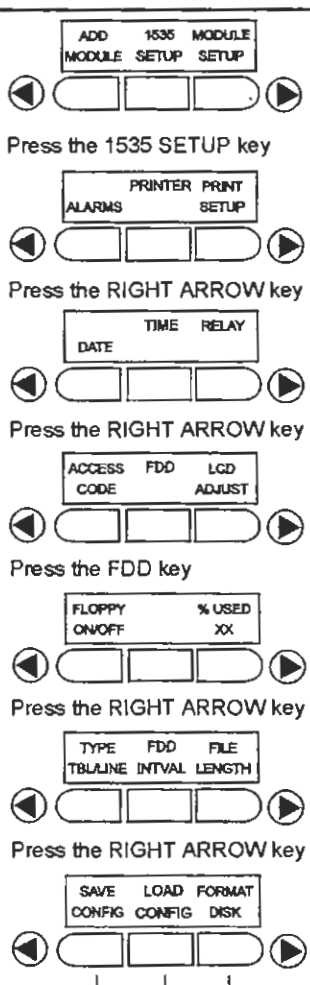
Data errors (high/low limit alarms, contact alarms, and RS-485 module communication alarms) are logged to the ALARM FILE. A sample alarm file is shown below.

```
010195 1556 1a 38.5 C HIGH LIMIT
(DATE TIME module# value descriptor alarm-type)
010195 1630 1a 37.5 C
(DATE TIME module# value descriptor return from alarm)
```


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Chart 11-1

Formatting a Diskette
Saving the 1535 Configuration
Loading a 1535 Configuration



Saves the complete 1535 configuration to a file named F1535.cfg

Loads the 1535 configuration from a diskette into the 1535

See Saving and Loading

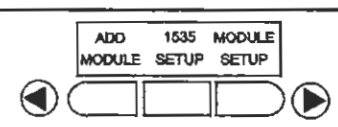
Formats a high density 3-1/2 inch diskette for 1.44 Mbytes of storage

See Formatting

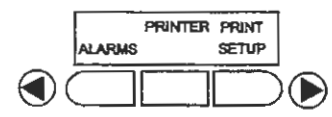
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Chart 11-2

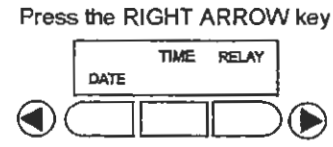
Customizing the FDD Data



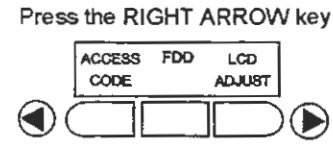
Press the 1535 SETUP key



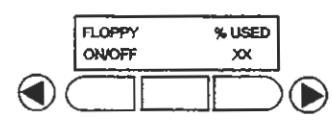
Press the RIGHT ARROW key



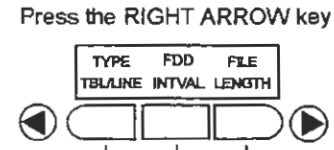
Press the RIGHT ARROW key

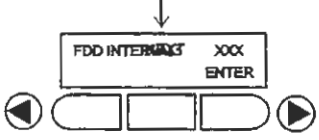


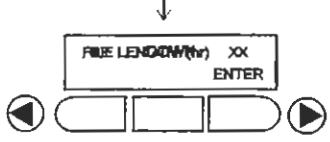
Press the FDD key



Press the RIGHT ARROW key







Press TYPE TBL/LINE to toggle between a line type data format and the table type data format.

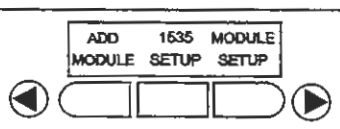
Press NEXT to view the available intervals for writing data to a file.
Press ENTER to select the interval shown in the display.

Press UP/DOWN to set the length of each file. This length can be set from 1 to 800 hours (33 days).
Press ENTER to select the length shown in the display.

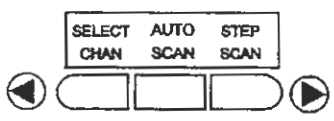
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Chart 11-3

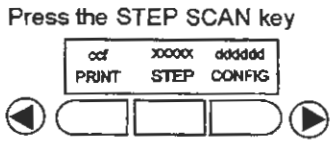
Directing Data to the FDD



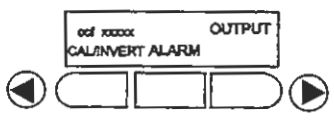
Press the MODULE SETUP key



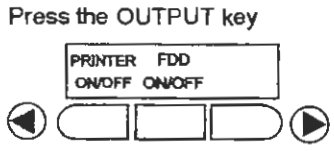
Press the STEP SCAN key



Press the STEP SCAN key until the desired channel, field and data value appears in the display. Press the CONFIG key when the desired data is in the display.



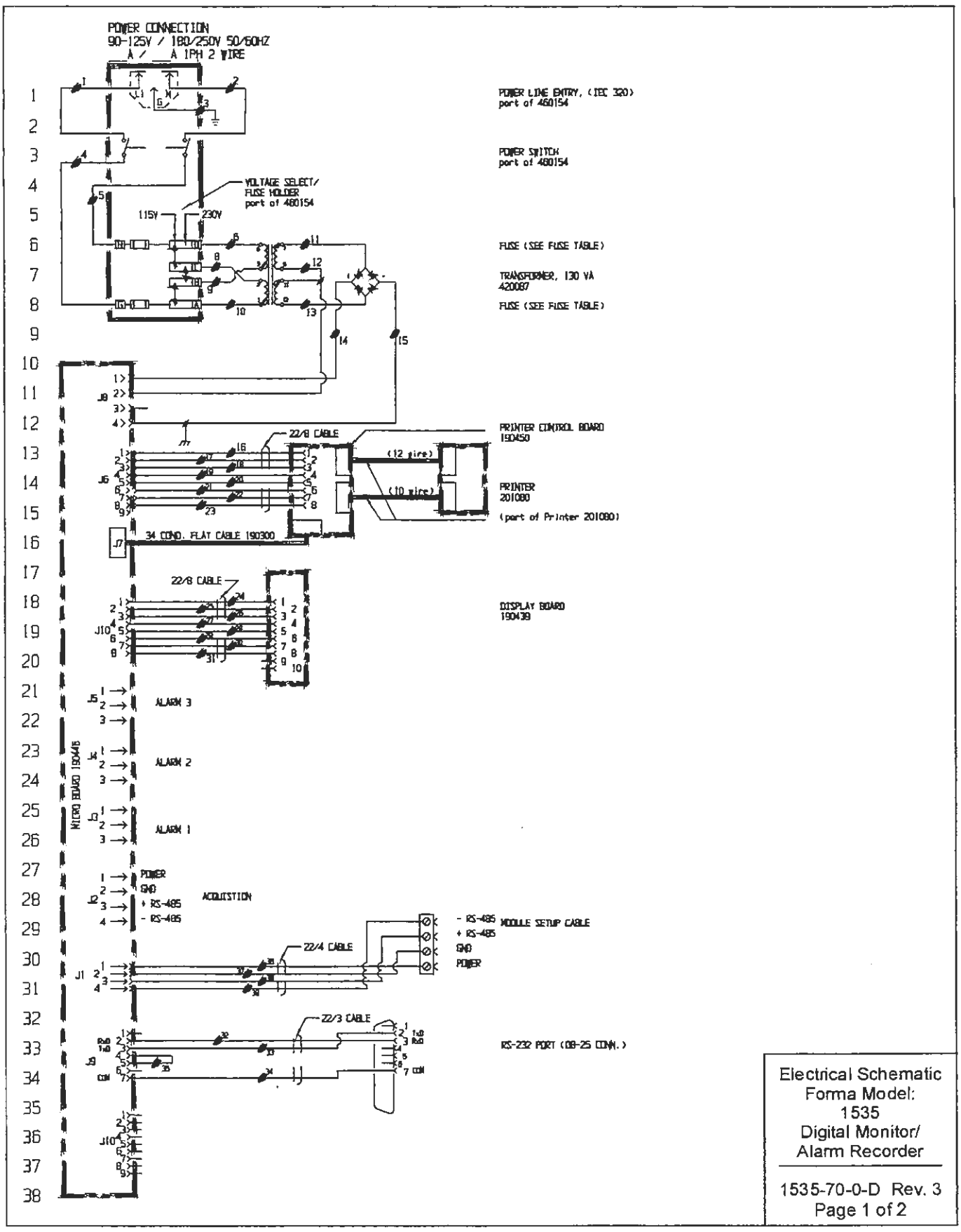
Press the OUTPUT key



Press the FDD key to toggle the Floppy Disk Drive on or off.

ON will direct this data to the floppy disk drive.

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Electrical Schematic
Forma Model:
1535
Digital Monitor/
Alarm Recorder

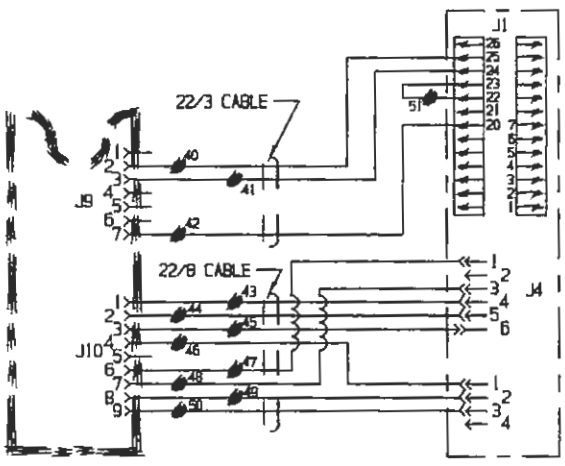
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WIRE REFERENCE CHART

NO.	GA	COLOR	NO.	GA	COLOR
1	18	BLACK	24	22/8	WHITE
2	18	WHITE	25	22/8	BLACK
3	18	GRN/YEL	26	22/8	RED
4	18	BLACK	27	22/8	GREEN
5	18	WHITE	28	22/8	BROWN
6	20	BLUE	29	22/8	BLUE
7		n/a	30	22/8	ORANGE
8	20	YELLOW	31	22/8	YELLOW
9	20	RED	32	22/3	BLACK
10	20	BROWN	33	22/3	RED
11	20	BLACK	34	22/3	GREEN
12	20	WHITE	35	22	YELLOW
13	20	ORANGE	36	22/4	RED
14	20	RED	37	22/4	BLACK
15	18	GRN/YEL	38	22/4	ORANGE
16	22/8	BLACK	39	22/4	YELLOW
17	22/8	WHITE	40	22/3	BLACK
18	22/8	RED	41	22/3	RED
19	22/8	GREEN	42	22/3	GREEN
20	22/8	BROWN	43	22/8	BLACK
21	22/8	BLUE	44	22/8	RED
22	22/8	ORANGE	45	22/8	GREEN
23	22/8	YELLOW	46	22/8	WHITE
			47	22/8	BROWN
			48	22/8	BLUE
			49	22/8	ORANGE
			50	22/8	YELLOW
			51	22	YELLOW

	FUSE TABLE	
VOLTAGE SELECT	TYPE UL198G	
	AMPS	STOCK #
115V	800mA	230141
230V	400mA	230149



"OPTIONAL" FLOPPY DISK DRIVE
190477

NOTES:
- Denotes Terminal Strip Connection
- Last Relay Number
- Last Terminal Number
- Last Wire Number

Parts List Reference Number
- Assembly
- Panel
- Refrigeration
- Wiring

CUSTOMER APPROVAL/REFERENCE
APPROVED BY
APPROVING FIRM
DATE OF APPROVAL

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Forma Scientific

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
3	AS-86	02-20-95	GLM	PDK	LDN	REVISED WIRE COLORS
2	AS-51	11-28-94	GLM	PDK	LDN	REMOVED RS-232 PORT CONNECTION
1	AS-48	09-19-94	GLM	PDK	LDN	REVISED WIRE COLORS (IEC-1010)
0	N/A	8-31-94	GLM	GLM	N.H.	RELEASED FOR PRODUCTION

DATE 6-20-94 | DWN GLM | CAD GLM | APPD N.H. | SCALE NONE
CUSTOMER
JOB TITLE 1535 DIGITAL MONITOR/ALARM RECORDER
DWG TITLE ELECTRICAL SCHEMATIC
LOCATION ALARMSYS01 | JOB NUMBER | DRAWING NUMBER 1535-70-0-D

Electrical Schematic
Forma Model:
1535
Digital Monitor/
Alarm Recorder

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THERMO FORMA STANDARD PRODUCT WARRANTY

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the first year warranty period.

During the first year, component parts proven to be defective in materials or workmanship will be repaired or replaced at Thermo Forma's expense, labor included. Installation and calibration are not covered by this warranty agreement. The Thermo Forma Service Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, glass, filters and gaskets are excluded from this warranty.

Replacement or repair of components parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original warranty period. The Thermo Forma Service Department must give prior approval for return of any components or equipment. At Thermo Forma's option, all defective parts must be returned to Thermo Forma postage paid and replacement parts are shipped FOB destination.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Thermo Forma shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Forma Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation and preventive maintenance.

If equipment service is required, please call your Thermo Forma Service Office at 1-888-213-1790 (USA and Canada) or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service and special application. Outside the USA, contact your local distributor for warranty information.

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THERMO FORMA INTERNATIONAL DEALER WARRANTY

The Warranty Period starts two months from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the first year warranty period. Dealers who stock our equipment are allowed an additional six months for delivery and installation, provided the warranty card is completed and returned to the Thermo Forma Service Department.

During the first year, component parts proven to be defective in materials or workmanship will be repaired or replaced at Thermo Forma's expense, labor excluded. Installation and calibration are not covered by this warranty agreement. The Thermo Forma Service Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, glass, filters and gaskets are excluded from this warranty.

Replacement or repair of components parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original warranty period. The Thermo Forma Service Department must give prior approval for return of any components or equipment. At Thermo Forma's option, all defective parts must be returned to Thermo Forma postage paid and replacement parts are shipped FOB destination.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Thermo Forma shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Forma Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation and preventive maintenance.

If equipment service is required, please call your Thermo Forma Service Office at 1-888-213-1790 (USA or Canada), or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service and special application. Outside the USA, contact your local distributor for warranty information.

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Rev. 1 1/01

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