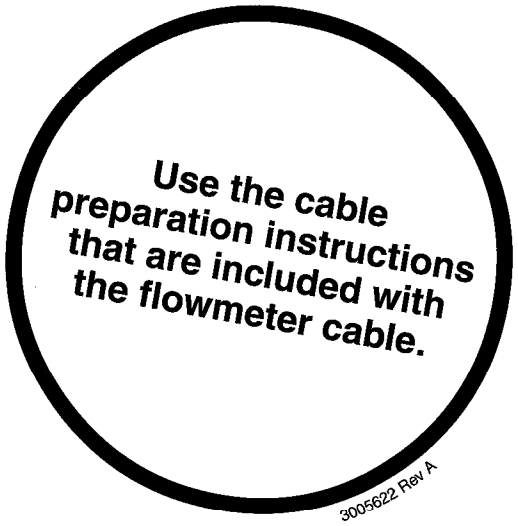
Model RFT9712
Remote Flow Transmitter

Instruction Manual

December 1992



Micro Motion

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Temperature Coefficients for Flow and Density

Please read this important notice if the sensor/transmitter/peripheral combination has not been factory-calibrated by Micro Motion.

To further improve the performance of our products, Micro Motion has changed the way sensor tube temperature is measured. A new RTD and mounting method have resulted in improved overall performance through:

- Improved response time to changes in fluid temperature
- Improved immunity to changes in ambient temperature
- Improved temperature input to the processor

As a result of the RTD change, the temperature coefficients for flow and density that are stated in this manual might be different from the values on the sensor serial number tag. The serial number tag carries the latest and correct values for the sensor. Failure to use the correct temperature coefficients may result in performance outside specifications.

Because the correct temperature coefficient will give you the best flowmeter performance, Micro Motion recommends using the values listed on the sensor serial number tag when reconfiguring the transmitter and peripheral device. **If the sensor, transmitter, and peripheral were ordered together as a flowmeter, they are factory-calibrated with the correct coefficients, and no reconfiguration is required.**

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1 The Remote Flow Transmitter

1.1 General Description

The Micro Motion® Remote Flow Transmitter (RFT9712) is a microprocessor-based mass flow transmitter. The RFT9712, in conjunction with a Micro Motion flow sensor, forms a complete mass flowmeter and density monitoring system.

This instruction manual explains how to install an RFT9712. Section 2 explains how to mount the RFT9712. Section 3 explains how to connect power-supply wiring, how to prepare signal cable that runs between the RFT9712 and a flow sensor, and how to set up the RFT9712 for various outputs. Section 4 explains jumper configuration, RFT9712 startup and zeroing procedures. Section 5 tells how to troubleshoot the RFT9712.

The RFT9712 converts the low-level signals from the sensor to 4-20 mA and frequency outputs. The 4-20 mA signal can be configured to transmit a density signal, a temperature signal, or the flow rate. The frequency output is always a flow rate signal. The RFT9712 also produces digital signals for flow rate, flow total, density, and temperature that can be read by a Rosemount® Model 268 SMART FAMILY® Interface or other control system compatible with HART® protocol. Alternatively, RS-485 can be selected as a digital communications medium.

Circuitry in the RFT9712 compensates for individual flow sensor characteristics, allowing interchange with any Micro Motion Model D, Model DL single-tube or Model DT high-temperature sensor.

The RFT9712 is available with an optional 4-line, 20-character liquid crystal display (LCD), which simultaneously shows flow rate, temperature, density and total flow, thereby allowing these variables to be monitored from the transmitter site.

1.2 Theory of Operation

The input circuit of the RFT9712 measures the signals from the left and right velocity detectors on the sensor tube(s). The input data is digitally filtered to reduce noise and increase the measurement resolution. This input data is then converted into flow rate data using the flow calibration factor and the sensed temperature.

The RFT9712 drive circuit generates an oscillatory voltage to vibrate the tubes. The oscillation frequency is the natural frequency of the sensor tubes. A process fluid density measurement therefore can be calculated from the measured natural frequency.

A temperature-signal amplifier converts the resistance of the sensor-mounted platinum RTD to a linearized voltage (i.e., 5 mV per °C). This temperature signal can be displayed on a Model 268 or on the RFT9712 transmitter's optional liquid crystal display (LCD). The temperature signal is used for temperature compensation of the sensor and for a temperature input to peripheral devices. The temperature compensation has a resolution of 0.1°C and a range of -240° to 450°C (-400° to 842°F).

1.3 Communication

The RFT9712 can be programmed to communicate with other digital equipment using the HART protocol. This is accomplished by using the RFT9712 mA output terminals.

Alternatively, an RS-485 communications interface is available through jumper configuration on the processor board and is compatible with the RFT9712 protocol.

The Model 268 allows direct digital configuration and access to diagnostics of the RFT9712. The Model 268 connects to the RFT9712 via the 4-20 mA current output loop and communicates with the RFT9712 at the transmitter site, from the control room, or from any other wiring termination point in the loop. The interface can also be used with Rosemount SMART FAMILY transmitters. For more information about the Model 268, see *Using the SMART FAMILY Interface 268 with the Micro Motion Remote Flow Transmitter* (P/N 1002657).

Note: A Model 268 with HART Version 5.0 is compatible with any RFT9712. However, a Model 268 with HART Version 4.0 will not operate with an RFT9712 that has HART Version 5.0. When the Model 268 is powered up, its display window automatically indicates the HART version installed in the Model 268. The following chart shows EPROM part numbers for both the Model 268 and the RFT9712, each with HART Version 4.0 or 5.0:

Table 1-1 EPROM Part Numbers, RFT9712 Transmitter and Model 268 SMART FAMILY® Interface With HART® Version 4.0 or 5.0

	HART 4.0	HART 5.0
RFT9712 transmitter EPROM P/N	0243501	0262801
Model 268 EPROM P/N's	268-2000-0071 268-2000-0072 268-2000-0073	268-2000-0081 268-2000-0082 268-2000-0083

1.4 Fault Detection and Diagnostics

The digital communications protocol is designed to assist in fault detection and diagnostics. Fault detection is designed to ensure the functional integrity of the sensor and electronics including the velocity transducers, drive coil, and RTD. During start-up, the RFT9712 microprocessor checks its RAM and EPROM. A watchdog timer monitors the operation of the microprocessor to ensure recovery from software malfunctions.

If a fault is detected that may indicate malfunction of the flowmeter, the mA and frequency outputs are set to an upscale or downscale level as an indication that a failure has occurred. Refer to Section 4.1, Jumper Configuration on the Processor Board, for information about choosing either downscale or upscale fault indication. Default settings are downscale 2 mA analog and 0 Hz frequency outputs. Also, the LED inside the terminal compartment flashes at 4 Hz if a fault condition occurs. The LED flashes at 1 Hz during normal operation. Detected faults can be displayed on the Model 268.

1.5 Meter Zeroing

Zero flow calibration (i.e., sensor offset adjustment) is accomplished with an externally wired set zero switch, with the communications protocol auto zero command, or with the set zero flow switch in the terminal compartment. Figure 1-1, the exploded-view drawing of the RFT9712, shows the location of the terminal compartment. During zero flow adjustment, the LED in the terminal compartment remains on indicating that a zero flow calibration is in progress. The RFT9712 will not allow an excessive sensor offset during meter zeroing, protecting against zeroing while excessive fluid flow exists. Refer to Section 4.3, Transmitter Auto Zeroing, for more information about zero flow calibration.

1.6 Independent Exchange of Flow Sensors and Transmitters

Transmitters and flow sensors may be replaced separately since each sensor is calibrated at the factory and marked with flow calibration and density calibration factors. Sensors and transmitters calibrated together at the factory have matching serial numbers on their respective nameplates. To match different transmitters and flow sensors, the calibration factors are entered into the RFT9712 using the communications protocol. No additional calibration or equipment is necessary. For sensors manufactured before calibration factors were put on each unit, phone Micro Motion at 1-800-522-MASS (1-800-522-6277).

1.7 Modular Electronics

The electronics in the RFT9712 can be removed from the housing and replaced separately. This is facilitated by modular construction and plug-in cable connectors (see Figure 1-1). Interchangeability allows one electronics module to serve as a spare for many RFT9712s.

1.8 Optional Display

The RFT9712 is available with an optional 4-line, 20-character liquid crystal display (LCD) in the upper compartment. The LCD simultaneously shows flow rate, temperature, density and total flow. This allows monitoring of these variables from the transmitter site. HART® protocol enables selection of the measurement units shown on the optional LCD. An asterisk (*) shows the process variable indicated by the 4-20 mA output signal, and flashes in synchronization with the lower-compartment LED to indicate the transmitter's operating status. The optional LCD requires HART Version 5.0 software (EPROM P/N 0262801). The LCD can be supplied with or without a totalizer reset button next to the display. The LCD is not readable when temperatures drop below 14°F (-10°C), but the LCD won't be harmed and won't affect other RFT9712 functions. Table 1-2 lists specifications for the RFT9712.

Table 1-2 Specifications

Functional Specifications

Sensor compatibility	All Model D, Model DL, and Model DT sensors.
Rangeability	Flow: See sensor specifications for minimum and maximum spans of individual sensors. The 75-to-1 electronics rangeability encompasses the range limits of the flow sensor. Zero may be suppressed or elevated. Density: Range limits from 0.0 to 5.0 g/cc. Minimum span 0.1 g/cc. Maximum span 5.0 g/cc. Temperature: Lower limit of -400°F (-240°C) Upper limit of 842°F (450°C) Minimum span of 20°C Maximum span of 690°C
Power Supply	Standard: 115 VAC ±25%, 48 to 62 Hz, 9 watts typical, 14 watts maximum or 230 VAC ±25%, 48 to 62 Hz, 9 watts typical, 14 watts maximum. Fuse rating: 0.25 amp. Optional: 12 to 30 VDC, 6.5 watts typical, 14 watts maximum. 1 amp minimum start-up current. Fuse rating: 2 amps.

Output Signals	Analog: 4 to 20 mA, internally powered, galvanically isolated to ±50 VDC, 0 to 1000 ohm load. Output can represent mass or volumetric flow rate, density or temperature. Maximum ripple of 1.5% of span at greater than 20 kHz. Frequency: 0 to 15 volt representing selected flow rate, 2.2k ohm pull-up, galvanically isolated to ±50 VDC. Sinking capability 0.10 amps in "on" condition (0 V level), 30 VDC compliance in "off" condition, with internal pull-up removed. Maximum pulse width of 24 millisec. Signal can be scaled from 1 to 10,000 Hz. Digital: Bell 202 digital communications signal superimposed on 4-20 mA signal, available for host system interface. Frequency 1.2 and 2.2 kHz, amplitude 1.0-2.0 mA peak-to-peak, baud rate 1200 bps. Load resistance of 250-1000 ohms required. HART protocol-compatible. Or, alternatively: Jumper-selected RS-485 digital communication signal referenced to sensor ground. Amplitude ±5 V square wave, baud rate 1200 bps. HART protocol-compatible. Flow Direction: 0 to 15 volt, 2.2k ohm pull-up, referenced to frequency output return line. Sinking capability 0.10 amps in "on" condition (reverse flow), 30 VDC compliance in "off" condition (forward flow), with internal pull-up removed. Sensor Frequency: 2.5 VAC at sensor natural frequency, referenced to sensor ground, 10k ohm output impedance. Used for interface with Micro Motion peripherals. Sensor Temperature: 5 mV/°C, referenced to sensor ground, 10k ohm output impedance. Used for interface with Micro Motion peripherals.
Slug Flow Inhibit	Transmitter senses density outside user-selected limits and drives flow outputs to indicate zero flow.
Scaled Low-Flow Cutoff	User-selected engineering units and low-flow cutoff value. Below selected value, digital, mA and frequency outputs are driven to zero.
Damping	User-selected time constant of 0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, or 12.8 seconds.
Out-of-Range Capability	Analog: 2 mA (-12.5% of span) to 22 mA (+112.5% of span) Frequency: To 11,520 Hz
Diagnostics	User-selected downscale (2 mA and 0 Hz) or upscale (22 mA and 11,520 Hz) indicates failure of auto zero, sensor, temperature sensor, or electronics.
Output Testing	Current source: Transmitter can commanded to supply a specified current between 2 and 22 mA. Frequency source: Transmitter can commanded to supply a specified frequency between 1 and 10,000 Hz.
Turn-On Time	Less than 15 seconds
Warm-Up Time	Transmitter reaches stable operation within 30 minutes.

Sensor Interchangeability	Sensors are flow and density calibrated and assigned calibration factors at the factory. Calibration factors can be entered into the transmitter, enabling interchangeability of sensors with a calibration shift within 0.1% of reading on flow accuracy, 0.001 g/cc on density accuracy and 0.5°C ±0.25% of reading in °C on temperature accuracy.
Hazardous Location Certification	UL: Class I, Division 2, Groups A, B, C, and D; Class II, Division 2, Groups F and G; hazardous locations. CSA: Class 1, Division 2, Groups A, B, C, and D. CENELEC: Safe area. SAA: Safe area.
Local Display Option	4-line, 20-character LCD indicates mass or volumetric flow rate, temperature, density, and mass or volumetric flow totals. An asterisk (*) shows process variable indicated by 4-20 mA output signal and flashes in synchronization with lower-compartment LED. Without optional LCD: Requires HART 4.0 or higher revision software. With optional LCD: Requires HART 5.0 or higher revision software.

Physical Specifications

Electronics Housing	NEMA 4X, epoxy polyester-painted, die-cast aluminum. Dimensions, without optional LCD: 9″ W by 12″ H by 3 5/8″ D (229 mm W by 305 mm H by 91 mm D) Dimensions, with optional LCD, but without reset button: 9″ W by 12″ H by 3 7/8″ D (229 mm W by 305 mm H by 96 mm D) Dimensions, with optional LCD and reset button: 9″ W by 12″ H by 4″ D (229 mm W by 305 mm H by 102 mm D) Weight, without optional LCD: 8.5 lb (3.9 kg) Weight, with optional LCD: 8.9 lb (4 kg)
Conduit Entrances	Three 3/4-14 NPT conduit entrances provided on base of transmitter
Electrical Connections	Screw terminals, provided for all connections, can be unplugged. Screw to housing for earth ground.
Cable from Sensor to Transmitter	3 individually shielded, twisted pairs, minimum 20 AWG, for 7 wire sensors. Less than 30 pF-per-foot interwire capacitance up to 500 ft (150 meters) total cable length. 4 individually shielded, twisted pairs, minimum 22 AWG, minimum 18 AWG for drive pair for 9-wire sensors. Less than 30 pF-per-foot interwire capacitance up to 1000 ft (300 meters) total cable length.

Performance Specifications

	Accuracy	Repeatability	Ambient Temp. Effect
Flow	±0.2% of rate ±ZS[1]	0.05% of rate ±1/2 of ZS[1]	Zero: ±0.1 x ZS[1]/°F Span: ±0.001% of span/°F
Density			
With DL100, DL200, D300 or D600	±0.001 g/cc	±0.0005 g/cc	±0.00005 g/cc/°F
With D65, DL65, DT65, D100, DT100, D150, DT150 or DH300	±0.002 g/cc	±0.001 g/cc	±0.0001 g/cc/°F
With D6, D12, D25, D40, DH65, DH100 or DH150	±0.004 g/cc	±0.002 g/cc	±0.0002 g/cc/°F
With DH6, DH12, DH25 or DH40	±0.008 g/cc	±0.004 g/cc	±0.0004 g/cc/°F
Temperature	±1° ±0.5% of reading in °C	±0.2°C	5 mV/°C output ±0.01°F/°F, 4-20 mA and digital outputs ±0.1°F/°F

[1]ZS = Sensor zero stability. Zero set at process temperature ±20°F (11°C)

Ambient Temperature Limits

Operating: -22 to 131°F (-30° to 55°C)[2]

Storage: -22 to 176° (-30 to 80°C)[2]

[2]The optional LCD is not readable when temperatures drop below 14°F (-10°C), but the LCD is not harmed and will not affect other RFT9712 functions.

Humidity Limits

Meets SAMA PMC 31.3, Section 5.2

RFI Effect (sensor included)

Level 1: ±0.25% of span at 1 V/m per IEC 801.3 - 1984

Level 2: ±1.00% of span at 3 V/m per IEC 801.3 - 1984

Class 3, A, B, C: ±0.25% of span at 1 V/m per SAMA PMC 33.1

Class 1, A, B, C: ±1.00% of span at 3 V/m per SAMA PMC 33.1 Conductive conduit for sensor cable, earth grounded at both ends, is required for RFI protection within this specification.

Vibration Effect (transmitter only)

Meets SAMA PMC 31.1, Level 2

Supply Voltage Effect (sensor included)

Meets supply voltage effect requirements of SAMA PMC 31.1 section 5.10.1 through 5.10.5

Electrostatic Discharge Effect (sensor included)

Class 4, 15 kV per IEC 801.2 - 1984

Figure 1-1
Exploded-View Drawing of RFT9712 Transmitter

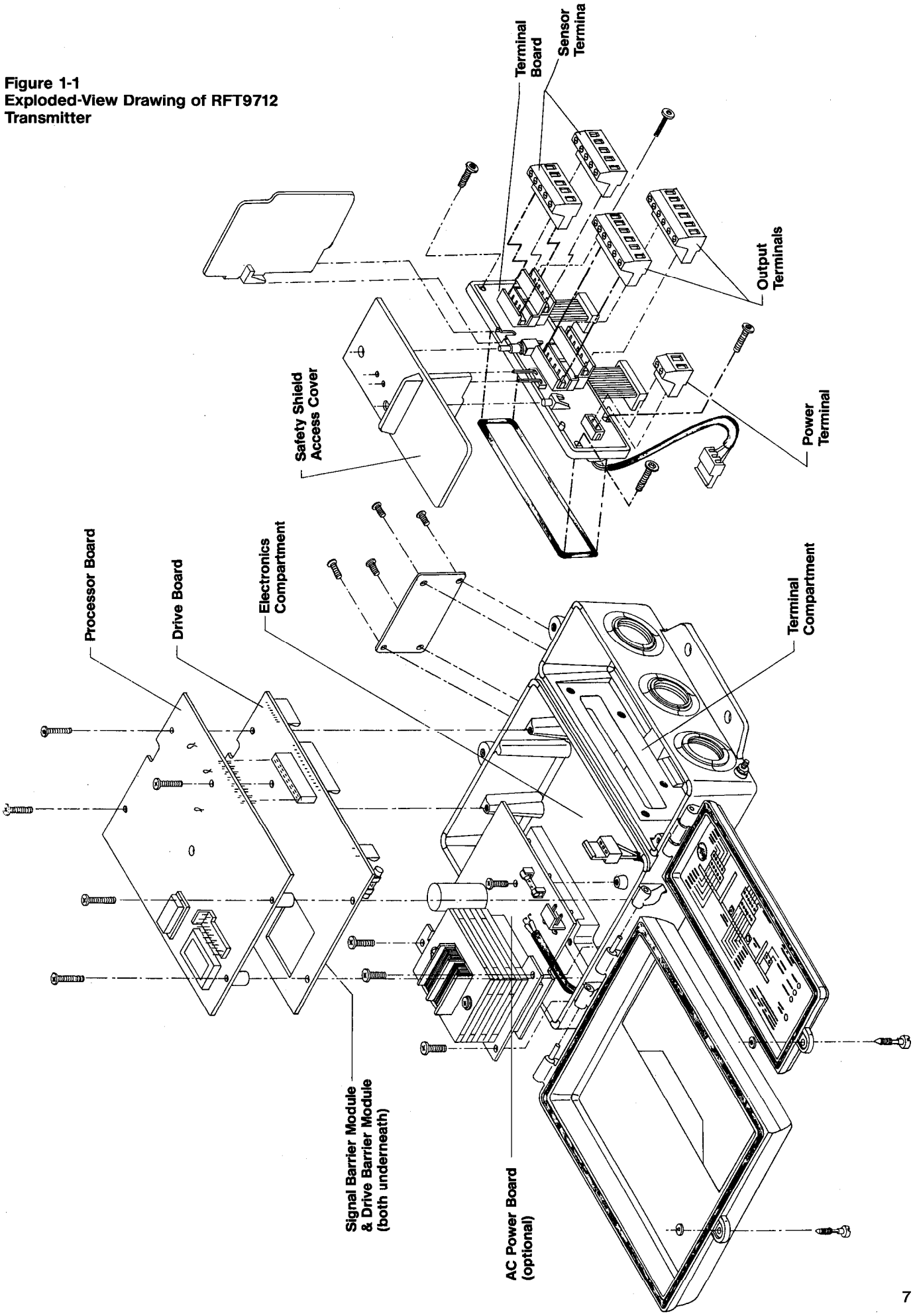


Figure 1-2
Mounting Dimensions, RFT9712
Transmitter

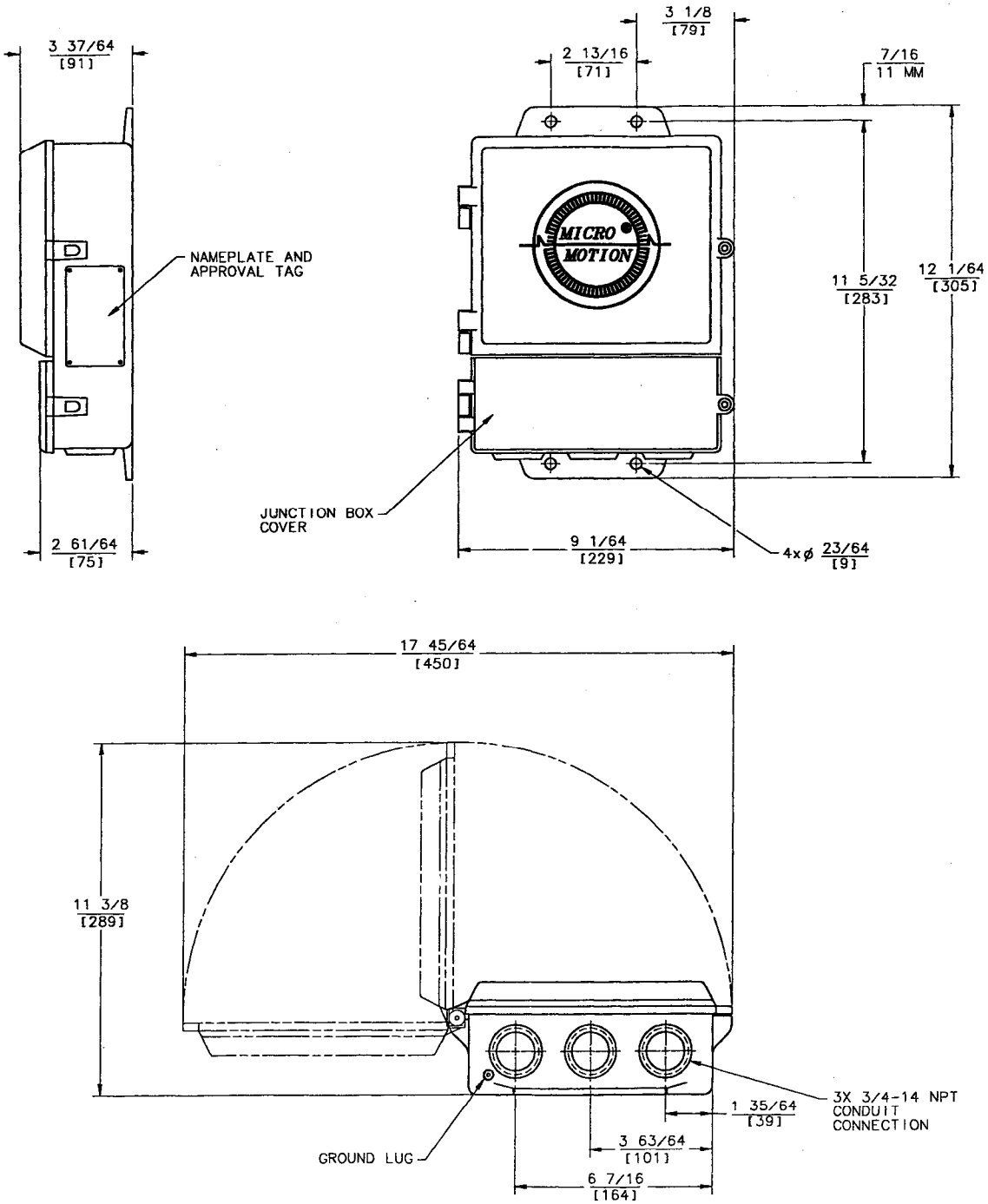
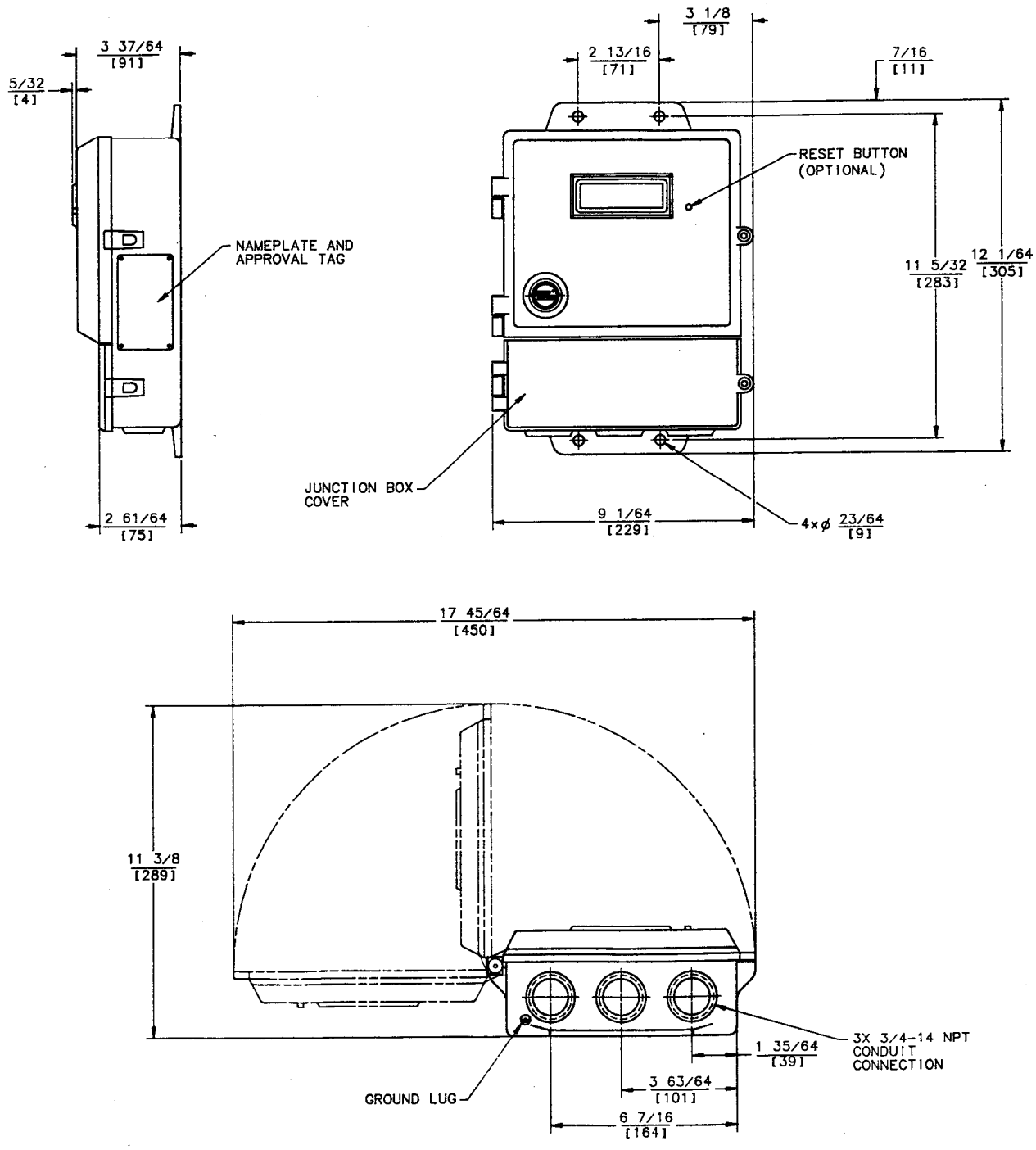


Figure 1-3
Mounting Dimensions, RFT9712
Transmitter With Display Option



2 Transmitter Mounting

2.1 General

The RFT9712 has upper and lower compartments. Terminal connections 0 through 9, for intrinsically safe output wiring, are in the lower compartment. To expose these terminal connections, loosen the lower screw on the right side of the RFT9712. It is not necessary to open the upper compartment to connect signal wiring as described in Sections 3.3 through 3.7. While installing signal wiring from the sensor or to an output device, keep the upper compartment closed to maintain a seal against the environment.

WARNING: To maintain intrinsic safety and to minimize electrical noise, DO NOT install power cables and signal cables inside the same conduit or cable tray.

An RFT9712 and a sensor can be replaced separately, because each sensor is factory calibrated and marked with its own density and mass flow calibration factors. The Model 268 allows flow and calibration factors to be entered into an RFT9712. *Using the SMART FAMILY Interface 268 with the Micro Motion Remote Flow Transmitter* (P/N 1002657) explains how to calibrate an RFT9712. No other calibration or equipment is needed.

2.2 Installing the RFT9712 Transmitter

When installing an RFT9712, follow these procedures:

Secure the wiring compartment covers to achieve a complete seal against moisture. Tighten the screws that hold the covers closed. Metal should touch metal on the housing protrusions within which the screw can be turned.

Mount the RFT9712 so it is accessible for calibration, servicing, data reconfiguration, and data reading.

Locate the RFT9712 in an easily accessible Division 2 hazardous area or safe area where ambient temperatures remain between -22° and 130°F (-30° and 55°C). For applications in which cable temperatures are above 150°F (65°C) or below 32°F (0°C), install the Micro Motion cable jacketed in light blue Teflon®. For applications in which cable temperatures stay between 32° and 150°F (0°and 65°C), install the Micro Motion cable jacketed in medium blue PVC.

WARNING: If interconnecting cable other than Micro Motion color-coded cable is to be installed, make sure the conductors are properly paired and shielded, and are the correct AWG gauge, to ensure reliable flowmeter performance. Section 3.3 explains how to pair wiring that is not color-coded.

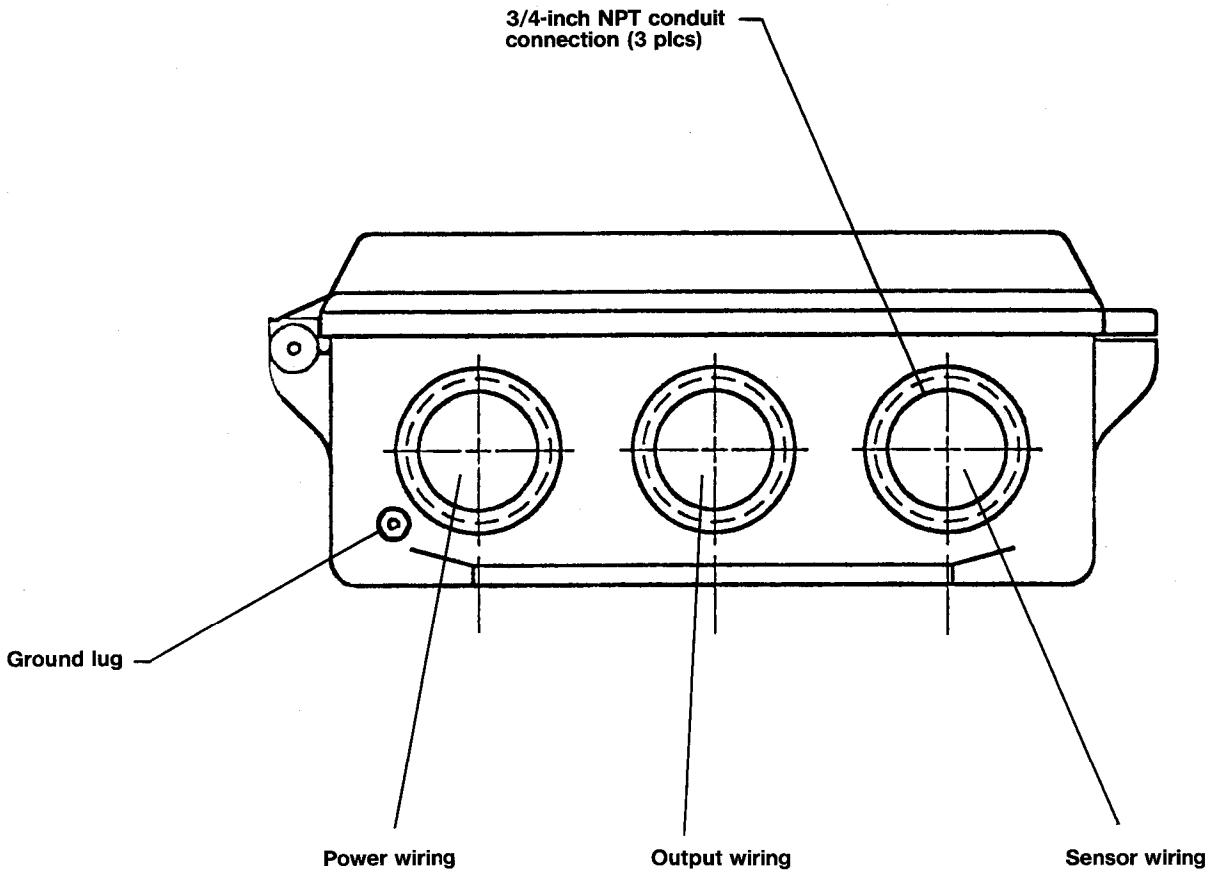
If bare cables are to be installed, make sure the cable jacket material is compatible with the application environment. Install corrosion-resistant cable or conduit and conduit connections if the flowmeter operates in a highly corrosive environment. If conduit is used, install seals to prevent liquid accumulation in the wiring termination areas.

Use PLTC cable or Teflon® sheathed wiring supplied by Micro Motion for cable tray installations.

The 3/4-inch NPT conduit openings on the bottom of the RFT9712 must remain sealed to keep the RFT9712 weather-tight. Use a conduit size that allows a complete seal with conduit openings of the RFT9712. Mount the RFT9712 vertically, with the smaller terminal compartment beneath the larger terminal compartment, to prevent moisture from accumulating at conduit connections.

The bottom of the RFT9712 has 3 separate 3/4-inch NPT conduit openings. One opening is for power wiring, one opening is for wiring to the sensor, and one opening is for output wiring. Figure 2-1 shows the location of these conduit openings.

Figure 2-1
Conduit Connections



3 Wiring

WARNING: Install cables and wiring so they meet local code requirements.

3.1 General

The following instructions explain how to install power-supply wiring, how to prepare interconnect cable running from the RFT9712 to a sensor, and how to make wiring connections for analog, frequency, density, flow-direction and communication outputs. Figure 3-1 shows terminal connections inside the lower compartment. Refer to Figures 3-2, 3-3, 3-4, and 3-5 for appropriate approval agency intrinsic safety wiring diagrams.

WARNING: Make sure power is off during connection of power-supply wiring.

3.2 Power-Supply Connections

The RFT9712 comes set up for 12 to 30 VDC, 100/115 VAC, or 220/230 VAC power inputs. The wiring label in the lower compartment indicates the input power rating for the RFT9712.

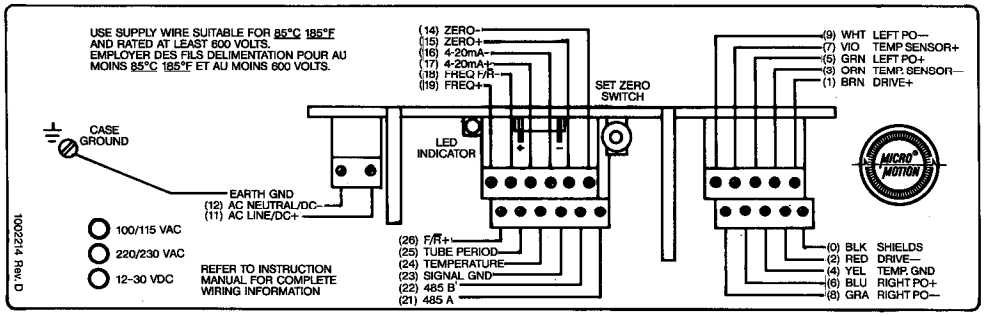
WARNING: Power-supply voltage must agree with the voltage indicated inside the lower compartment.

Make input power connections at terminals 11 and 12. For easier wiring and service, disconnect individual terminal blocks and remove them from the housing. If the RFT9712 has an AC power supply, terminal 11 is line and terminal 12 is neutral. If the RFT9712 has a DC power supply, terminal 11 is positive and terminal 12 is neutral. The ground lug, which establishes chassis ground, **must** be connected to earth ground.

WARNING: Failure to connect the earth ground to the ground lug in the lower compartment will nullify the sensor's intrinsically safe electrical rating.

WARNING: The terminal-connection area of the RFT9712 is partitioned to separate intrinsically safe wiring from wiring that is not intrinsically safe. Intrinsically safe wiring to the sensor is in the right side of the lower compartment and is labeled "Intrinsically Safe Terminals." These terminals are reserved for signal wiring from the sensor.

Figure 3-1
Terminal Compartment Connections



3.3 Signal Wire Pairing

Use the interconnect cable to make signal wiring connections between the sensor and terminals 0 through 9 in the lower compartment of the RFT9712.

If color-coded cable supplied by Micro Motion is NOT being installed, use 18 gauge or larger diameter wire and make sure each pair of wires has its own shield. The ground shield for the wire pair connected at terminal 3 and 7 must be connected to the yellow wire at the sensor manifold spacer/junction box and to terminal 4 at the RFT9712. Make sure the bare shields have insulation that will prevent them from shorting out from contact with the sensor case or other parts.

For 7-wire feedthrough sensors, keep wires paired according to the following pattern:

- Wires connected to RFT9712 terminals 1 (brown) and 2 (red) must be paired together.
- Wires connected to RFT9712 terminals 3 (orange) and 7 (purple) must be paired together.
- Wires connected to RFT9712 terminals 5 (green) and 6 (blue) must be paired together.
- Connect the wires from RFT9712 terminals 3 and 7 to sensor terminal 4 (yellow).
- Ground shields for the other pairs of wires connect to terminal 0 at the RFT9712 and should not be connected at the sensor.

For 9-wire feedthrough sensors, keep wires paired according to the following pattern:

- Wires connected to RFT9712 terminals 1 (brown) and 2 (red) must be paired together.
- Wires connected to RFT9712 terminals 3 (orange) and 7 (purple) must be paired together.
- Wires connected to RFT9712 terminals 5 (green) and 9 (white) must be paired together.
- Wires connected to RFT9712 terminals 6 (blue) and 8 (gray) must be paired together.
- Ground shield for the pair of wires from RFT9712 terminals 3 and 7 must connect to sensor terminal 4 (yellow).
- Ground shields for the other pairs of wires connect to terminal 0 at the RFT9712 and should not be connected at the sensor.

3.4 Cable Preparation

For applications in which cable temperatures are above 150°F (65°C) or below 32°F (0°C), install the Micro Motion cable jacketed in light blue Teflon®. For applications in which temperatures stay between 32° and 150°F (0° and 65°C), install the Micro Motion cable jacketed in medium blue PVC. Up to 1000 feet of color-coded cable supplied by Micro Motion can be installed between the RFT9712 transmitter and the sensor. PLTC cable rated at -40°F to 220°F (-40°C to 105°C) is also available from Micro Motion.

Parts List

The cable preparation package contains the following:

Two pieces of 1-inch (25-mm) black tubing
One piece of 3-inch (75-mm) yellow tubing
One piece of 4-inch (100-mm) yellow tubing
One piece of 4-inch (100-mm) black tubing
Nine spade lugs

Some installations do not require all the parts.

WARNING: Carefully prepare cables to avoid grounding the shields to the RFT9712 case or to conduits.

3.4.1 RFT9712 Transmitter-End Cable Preparation

Micro Motion cable is shipped with the prepared cable end which connects to the RFT9712. If conduit is being installed, run the RFT9712 cable through the conduit and seal fitting from the RFT9712 to the sensor before preparing the cable ends.

To prepare the cable end connected to the RFT9712, perform the following steps:

1. Remove a 4-inch (100-mm) length of sheathing from the cable, and remove the fibrous material between the wires. DO NOT yet separate the twisted pairs of shielded wires.

2. Remove the foil wrapping around the **violet/orange** pair of wires and separate them.

3. Slip the 4-inch (100-mm) piece of yellow tubing over the shield of the **violet/orange** pair of wires. Leave as little distance as possible between the yellow tubing and the cable sheathing to reduce the amount of exposed shield.

4. Remove the foil wrapping around the other 3 pairs of shielded wires and separate them. Twist the 3 remaining shields together. Slip the 4-inch (100-mm) piece of black tubing over these 3 shields and push the tubing as close as possible to the cable sheathing.

5. Slip one piece of the 1-inch (25-mm) black heat-shrink tubing over the wires and cable sheathing. The tubing should completely cover all exposed portions of the shields.

6. Without burning the cable, use a heat gun to shrink the tubing.

7. After the cable has cooled, strip 1/4 inch (6 mm) of insulation from the individual wires. If less than 1/4 inch (6 mm) of shielded wire extends from the yellow or black tubing, trim the tubing.

3.4.2 Sensor-End Cable Preparation

To prepare the cable end connecting to the sensor, perform the following steps:

1. Remove a 3-inch (75-mm) length of sheathing from the cable, and remove the fibrous material between the wires. DO NOT yet separate the twisted pairs of shielded wires.

2. Remove the foil wrapping around the **violet/orange** pair of wires, separate them and separate the shield from this pair.

3. Slip the 3-inch (75-mm) piece of yellow tubing over the shield of the **violet/orange** pair of wires. Leave as little distance as possible between the yellow tubing and the cable sheathing to reduce the amount of exposed wire.

4. Remove the foil wrapping around the other 3 pairs of shielded wires and separate them. Clip each shield off as close as possible to the cable sheathing.

5. Slip one piece of the 1-inch (25-mm) black heat-shrink tubing over the all the wires and cable sheathing. The black tubing should completely cover all portions of the **violet/orange** wire shield remaining exposed next to the cable sheathing.

6. Without burning the cable, use a heat gun to shrink the tubing.

7. After the cable has cooled, strip 1/4 inch (6 mm) of insulation from the individual wires. If less than 1/4 inch (6 mm) of shielded wire extends from the yellow tubing, trim the tubing.

3.5 RFT9712 Transmitter Connections

Remove the detachable terminal connectors from the transmitter's lower compartment. Connect the stripped ends of the individual wires as described below. Insert the wired terminal connectors into the lower compartment. Replace and tighten the terminal-connection cover before operating the flowmeter.

RFT9712
Terminal Number

0..... Black wire	1..... Brown wire
2..... Red wire	3..... Orange wire
4..... Yellow wire	5..... Green wire
6..... Blue wire	7..... Violet wire
8..... Gray wire	9..... White wire

3.6 Sensor Connections

Refer to figures 3-2, 3-3, 3-4, and 3-5 for proper wiring of the RFT9712 to Micro Motion Model D flow sensors. Wiring connections to the sensor are made within the supplied junction box or with the optional Cam-lok quick-connector. The junction box is not attached to the sensor when shipped. Unscrew the junction box cover to access the 9-position terminal strip. Attach and position the junction box to the sensor base as desired.

Wiring instructions are placed in the junction box when it is shipped with a sensor from the factory. Refer to those instructions when making connections to the sensor. Insert the stripped ends of the individual wires into the removable terminal block inside the sensor junction box. No bare wires should remain exposed. Make sure to match the wire colors of the interconnecting cable with the wire colors at the sensor wiring terminal as shown below:

Terminal Number	Wire Color
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Gray
9	White

The conduit fitting on the sensor junction box is a 3/4-inch NPTF opening. Connect the opening to a 3/4-inch NPT male cable grip or flexible conduit. The cable grip must be compatible with the operating environment. For example, install corrosion-resistant cable grip or conduit and conduit connectors in corrosive environments. Use conduit connectors and seals to prevent moisture from accumulating in wiring terminals.

Intrinsic safety can be maintained for the signal wiring between the RFT9712 and all sensors without explosion-proof conduit, although connections must be waterproof.

Model D, Model DL and Model DT sensors are available with an optional Cam-lok quick-connector. With this option, Micro Motion supplies 20 feet (6 meters) of PVC-jacketed cable and a 9-pin connector for the sensor junction box. For cable runs longer than 20 feet, splicing or a user-supplied junction box will be required.

3.7 Output Signal Wiring

To avoid possible electrical interference, keep wiring to peripheral devices separated from input power wiring. A separate entrance is provided for wiring to peripheral devices. Outputs are not intrinsically safe.

3.7.1 Analog

Use terminals 16 and 17 on the RFT9712 when connecting a receiver to the milliamp output circuit. Terminal 17 is the signal line (+); terminal 16 is the return (-). It is not necessary to ground the negative signal (terminal 16) since it is galvanically isolated up to ±50 VDC. Use twisted-pair, shielded cable for long runs of cable.

The 4-20 mA output signal can supply loop-powered process indicators such as the Micro Motion Model PI 4-20 Process Indicator. SMART FAMILY communication requires a minimum loop resistance of 250 ohms. Loop resistance cannot exceed 1000 ohms in any case. Connect shields for output wiring to ground at RFT9712 terminal 23.

3.7.2 Frequency

The frequency output is galvanically isolated to ±50 VDC. The output circuit is rated to 30 VDC, with 0.1 ampere maximum sinking capability. Transmitter output is a nominal 15-volt logic-level square wave, unloaded. Output impedance is 2.2k ohms at the 15-volt logic level. If the signal receiver is NOT a Micro Motion peripheral device, check the instruction manual for the receiver to make sure its input-voltage and electrical-current ratings match the output-voltage and electrical-current ratings of the RFT9712.

To connect a frequency output receiver, use terminal 19 (+) as the signal line and terminal 18 (-) as the return. Install twisted-pair, shielded cable, 22 gauge or larger, for the frequency output wiring. Connect shields for output wiring to ground at RFT9712 terminal 23.

3.7.3 Flow Direction

To connect the RFT9712 for indication of flow direction, use terminal 26 (+) as the signal line and terminal 18 (-) as the return. The output circuit is rated to 30 VDC, with 0.1 ampere maximum sinking capability. Transmitter output is a nominal 0-15 volt logic level, unloaded. Output impedance is 2.2k ohms at the15-volt logic level. With forward flow, the output is high (+15 V); with reverse flow, the output is low (0 V). Near zero flow, this output might be either high or low due to zero stability. The flow-direction output can function as an input to directional totalizers such as the Micro Motion Digital Rate Totalizer (DRT).

3.7.4 Density

To connect the RFT9712 for density output to a Micro Motion Density Monitoring System (DMS), Net Oil Computer (NOC) or Net Flow Computer (NFC), use 3-wire shielded cable. DO NOT install more than 500 feet of shielded cable between the RFT9712 and the peripheral device. Install 22-gauge or larger diameter wiring.

Table 3-1 **Wiring, RFT9712 Transmitter to DMS, NOC or NFC Peripheral**

RFT9712 Terminal #	DMS, NOC or NFC Terminal #	Signal Description
23 to	10	Signal ground
24 to	8	Temperature
25 to	9	Tube period
23 to	None	Ground shield
DMS/NOC/NFC Jumper Wire		
None	10 to 7	Reference ground

3.7.5 RS-485 Serial Communication

To connect the RFT9712 to an RS-485 network, use terminal 21 as the "A" line and terminal 22 as the "B" line. DO NOT install more than 4000 feet (1200 meters) of twisted-pair cable, consisting of 24 gauge or larger diameter wire, between the RFT9712 and an RS-485 communication device. Install twisted-pair, shielded cable to pass through any area that might produce electromagnetic interference.

Install a 120-ohm, 1/2 watt resistor at each end of the network cable. These termination resistors ensure proper communications by reducing electrical reflections in the cable. Figure 3-6 shows how to connect one RFT9712, or multiple RFT9712 transmitters, to a host controller for RS-485 serial communication.

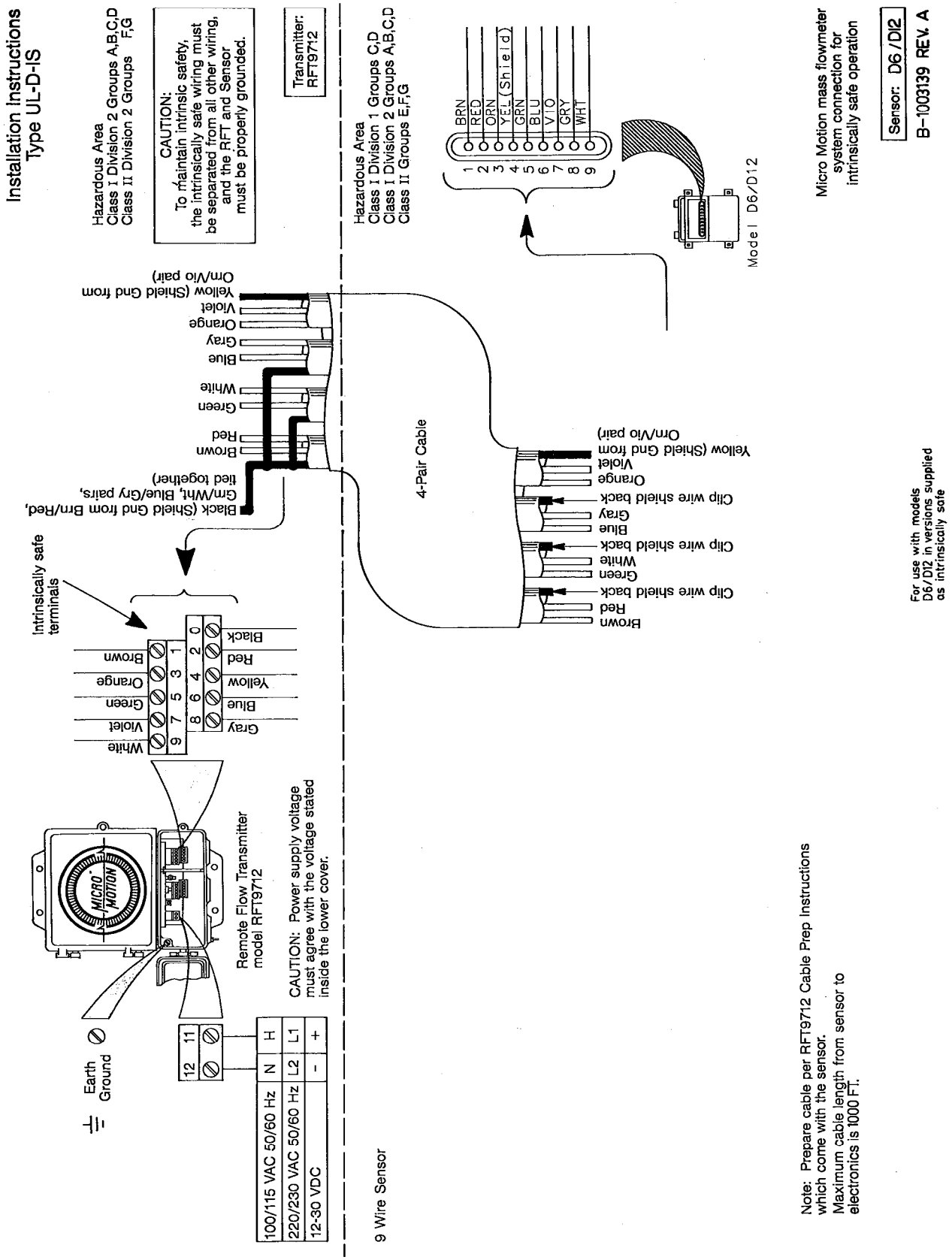
Up to 15 RFT9712 transmitters can be connected into a RS-485 serial communication network. Using the RFT9712 in a networking (multidrop) mode requires assigning a unique address to each RFT9712 to prevent them from contending with each other for the line. In the RS-485 networking mode, the "485 mA Live" jumper selection can be engaged to preserve active milliamp outputs on each RFT9712. Section 4.1 tells how to configure jumpers on the processor board of the RFT9712. For detailed information on communication protocol requirements for implementing an RS-485 network, phone 1-800-522-MASS (1-800-522-6277).

3.7.6 Milliamp Output for Multidrop Network

To connect the RFT9712 in a HART-compatible network, connect the milliamp outputs from each RFT9712 together so they feed into a common load resistor with approximately 250 ohms impedance. Each RFT9712 must be assigned a unique multidrop address, consisting of any number from 1 through 15. Doing this will cause the milliamp output to default to a constant 4 mA level. DO NOT engage the "4 mA Live" jumper in this mode of operation.

A maximum of 10 transmitters can be connected into a single HART-compatible multidrop network. Other Rosemount SMART FAMILY transmitters can participate in a HART-compatible network. Figure 3-7 shows how to connect wiring for a HART-compatible network. A single Model 268 or HART-compatible control system can communicate with any of the transmitters in the network over the same 2-wire pair.

Figure 3-2
Type UL-D-IS Wiring Diagram for the D6 and D12



Note: Prepare cable per RFT9712 Cable Prep Instructions which come with the sensor.
Maximum cable length from sensor to electronics is 1000 FT.

Figure 3-3
Type UL-D-IS Wiring Diagram for the D25 through D600

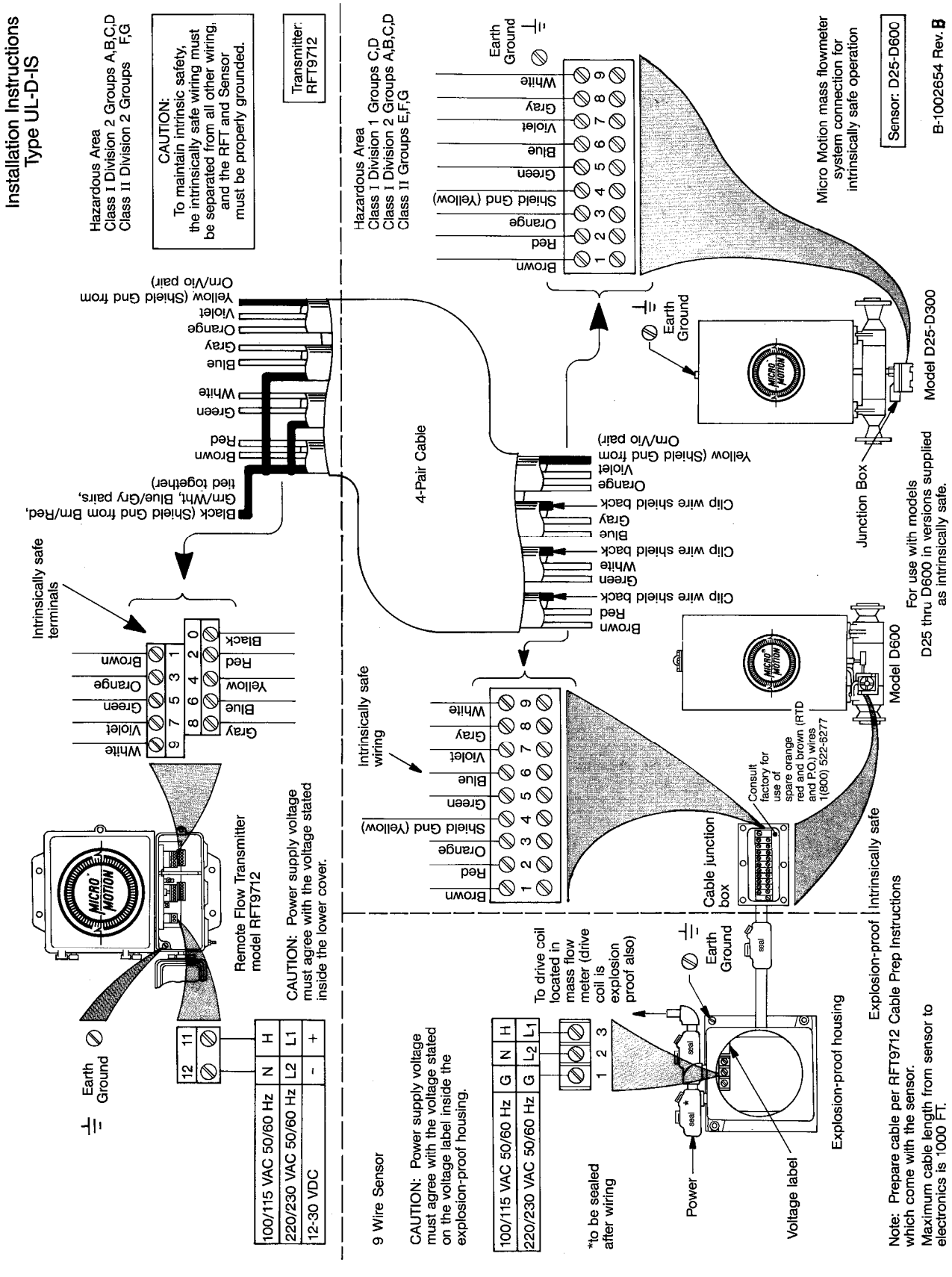


Figure 3-4
Type SAA-D-IS Wiring Diagram for the D6 through D300

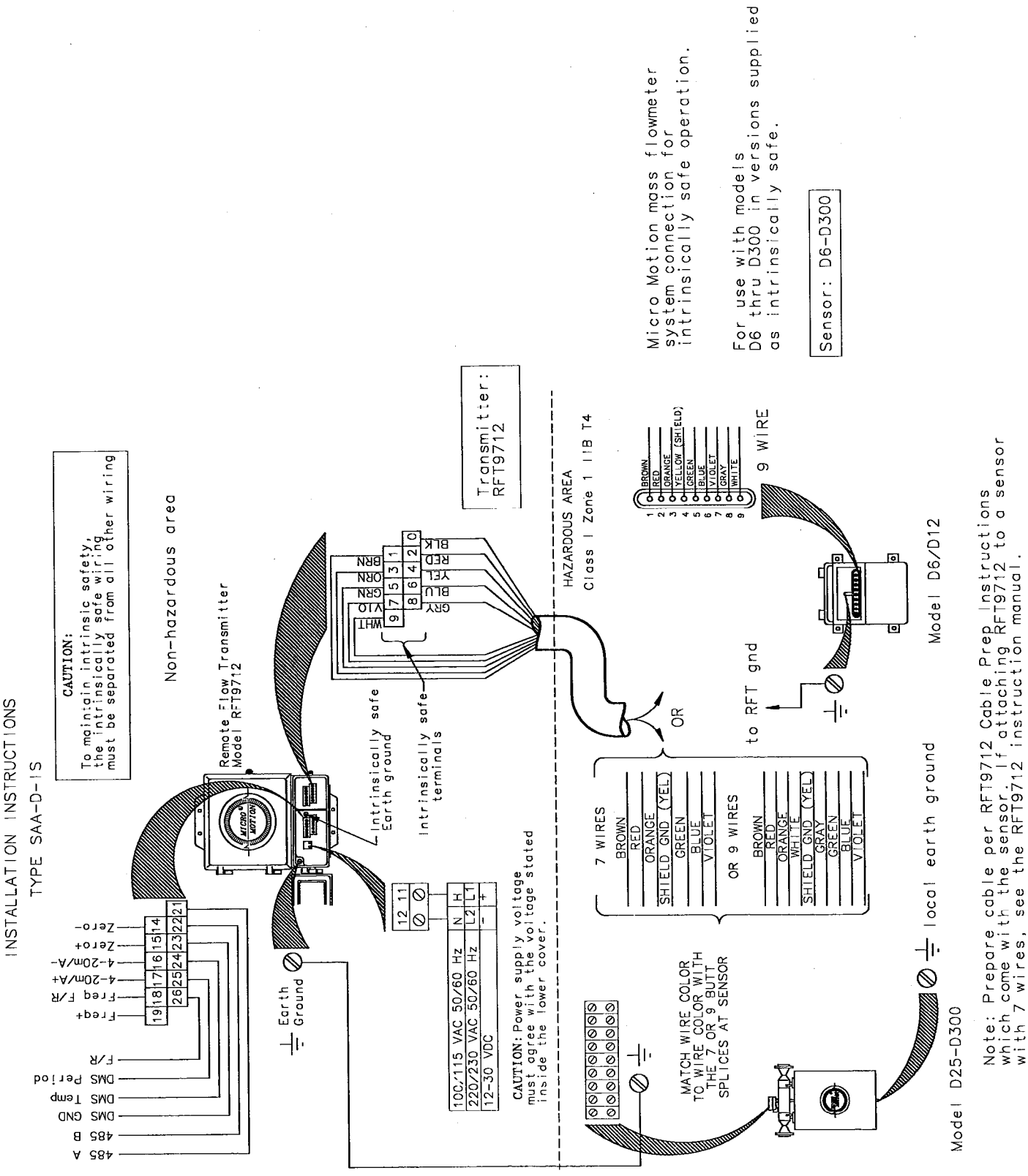


Figure 3-5
Type CSA Wiring Diagram for the D6 through D300

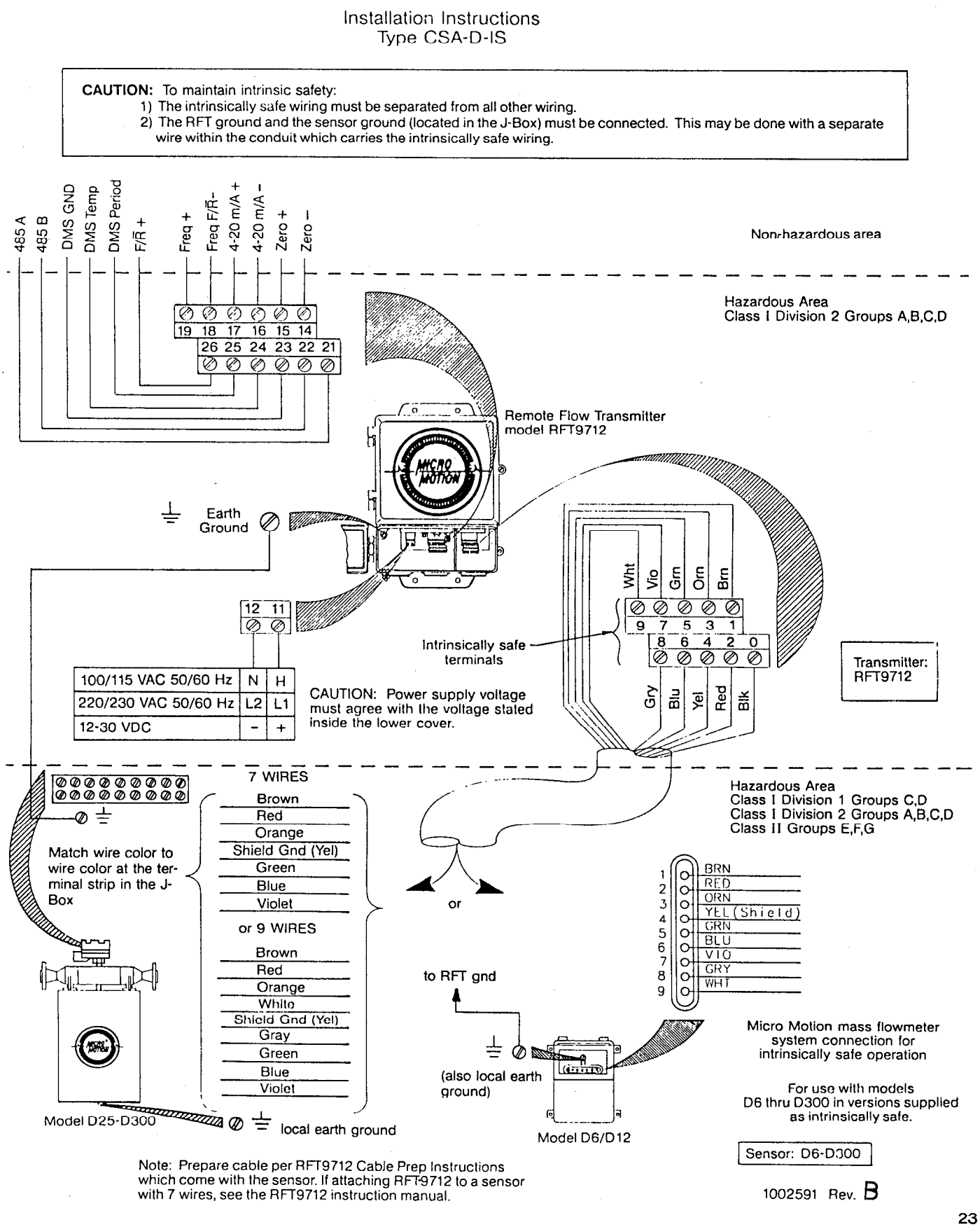
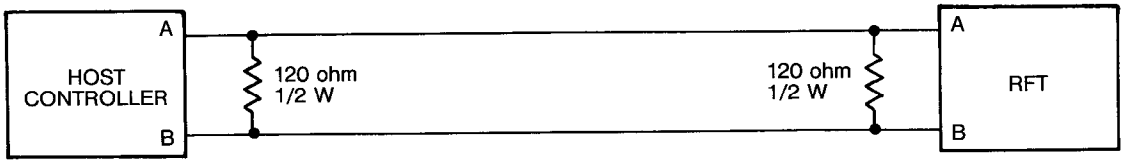


Figure 3-6
RS-485 Wiring

One RFT and a host controller



Multiple RFT's and a host controller

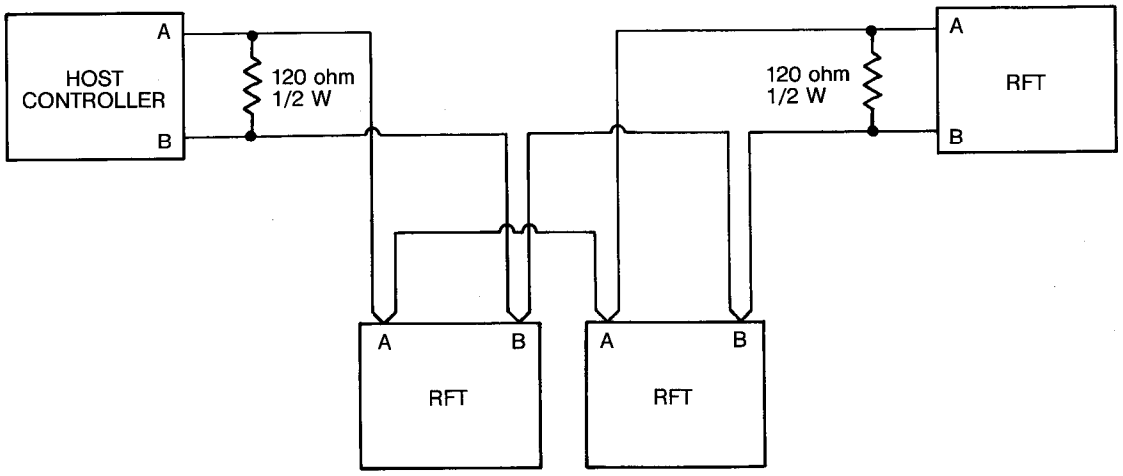
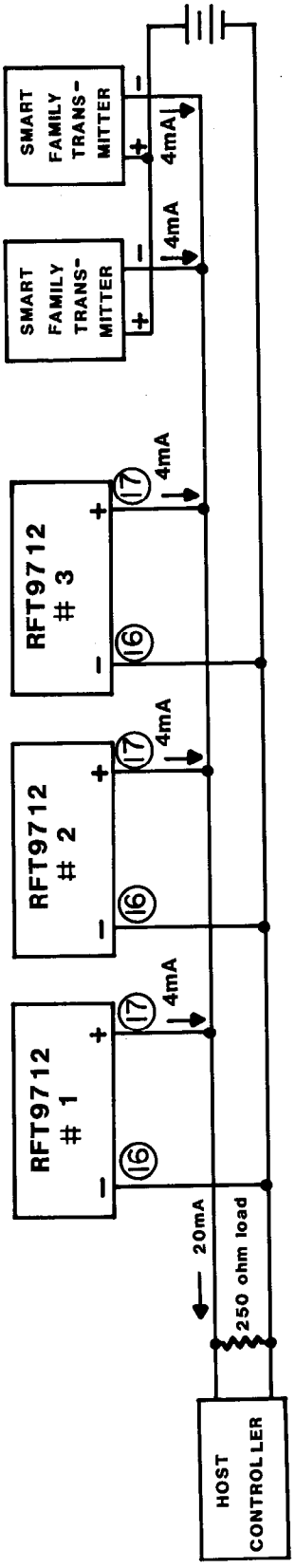


Figure 3-7
HART Network Wiring



4 Start-Up

4.1 Jumper Configuration on the Processor Board

Jumpers on the processor board are used to configure the RFT9712. Figure 4-1 shows location of jumpers on the processor board and the arrangement of the jumpers. They are labeled DISABLE/ENABLE, SCALE DWN/UP, 485/268 and 485 mA Live. They are configured at the factory for DISABLE, SCALE DWN, and 268, without a jumper for 485 mA live unless otherwise specified on the sales order.

WARNING: Turn off power while changing the position of jumpers.

To change the jumper settings, open the upper compartment cover to access the processor board. Figure 1-1 is an exploded-view drawing that shows the location of the processor board and other circuit boards. After configuring the jumpers, securely close the upper compartment cover to maintain its environmental seal.

DISABLE/ENABLE (write protect): With this jumper set to DISABLE, the RFT9712 will allow configuration changes to be made using the communications protocol. With the jumper set to ENABLE, the following error message will appear if an attempt is made to enter configuration changes into the Model 268:

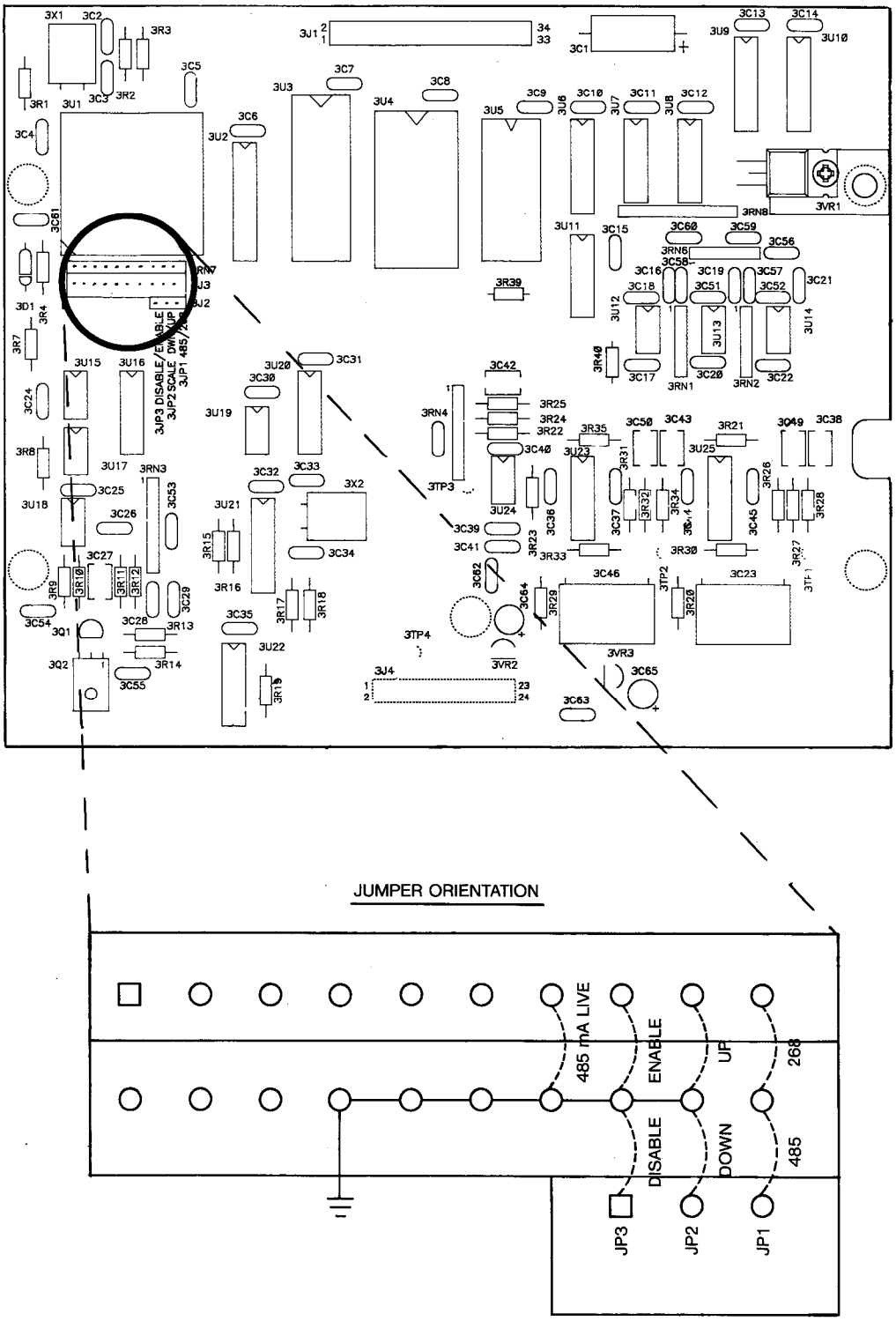
ERR-Xmtr Security On Pro- ceed

SCALE DWN/UP: This jumper establishes the fault alarm (i.e., sensor failure, electronics failure, or temperature sensor out of range) for the top or bottom of the mA or frequency scale. If a fault condition occurs with the jumper set for UPSCALE, the LED in the terminal compartment flashes at a rate of 4 Hz, the frequency output goes to 11,520 Hz, and the milliamp output goes to 22 mA. If a fault condition occurs with the jumper set for DOWNSCALE, the LED in the terminal compartment flashes at a rate of 4 Hz, the frequency output goes to 0 Hz, and the milliamp output goes to 2 mA.

485/268: This jumper allows configuration of the RFT9712 for communication via RS-485 or Bell 202 signal standards. The Model 268 requires the Bell 202 signal standard. Therefore, with the jumper set for RS-485 communication, the Model 268 cannot be used to configure the RFT9712. If RS-485 communication is selected, terminals 21 and 22 are used for digital communications.

485 mA Live: If a multidrop address other than 0 is assigned to the RFT9712, the milliamp output automatically defaults to a constant 4 mA level unless this jumper is engaged. Use this jumper if several transmitters are in an RS-485 multidrop arrangement and the analog output is to remain live. The jumper does not need to be engaged unless the multidrop RS-485 feature is used.

Figure 4-1
Location of Jumpers on the Processor Board



4.2 Power

After correctly wiring the flowmeter, power voltage can be supplied to the RFT9712. The LED indicator in the terminal compartment flashes on at a rate of 1 Hz to indicate proper operation of the flowmeter.

4.3 Transmitter Auto Zeroing

Close the shutoff valve downstream from the sensor. The sensor should be completely filled with the process fluid. Fluid flow through the sensor must be completely stopped or the zero flow setting will be incorrect. Problems setting zero flow occasionally occur because of leakage through valves.

The RFT9712 can be zeroed in three ways: 1) with the internal set zero switch, 2) with a remote set zero switch (wired across terminals 14 and 15), and 3) with an auto zero command from the Model 268. The LED in the terminal compartment turns on after 2 seconds of zero switch closure and remains on continuously during calibration of zero flow. Section 4.4 explains how to use the terminal compartment LED.

Zeroing normally takes about 30 seconds. After the zeroing procedure has been completed, the terminal compartment LED will again flash on at a rate of 1 Hz. If auto zeroing fails, the terminal compartment LED will flash at a rate of 4 Hz to indicate an error condition. An auto zero error condition could signify that excessive fluid is still flowing, that the sensor tubes are not completely full, or that the sensor is improperly mounted. To clear an auto zero error, perform another auto zero after correcting the problem or turn power off, then on again.

4.4 Using the Terminal Compartment LED

The terminal compartment LED indicates any of 4 conditions.

1. The LED flashes on at a rate of 1 Hz (on 25% of the time, off 75% of the time) during nominal operation.

2. The LED remains on continuously when a zero flow calibration (auto zero) is in progress.

3. The LED flashes on at 4 Hz if a fault condition occurs.

4. The LED blinks off at a rate of 1 Hz (on 75% of the time, off 25% of the time) during a slug flow condition.

4.5 Local Display Option Function

The optional 4-line, 20-character LCD display simultaneously displays flow rate, temperature, density, and totalized flow. Units of measure can be selected through the HART protocol or a Model 268 or via RS-485 communication.

An asterisk (*) is displayed next to the 4-20 mA variable. This asterisk flashes in synchronization with the terminal compartment LED described in Section 4.4 (above).

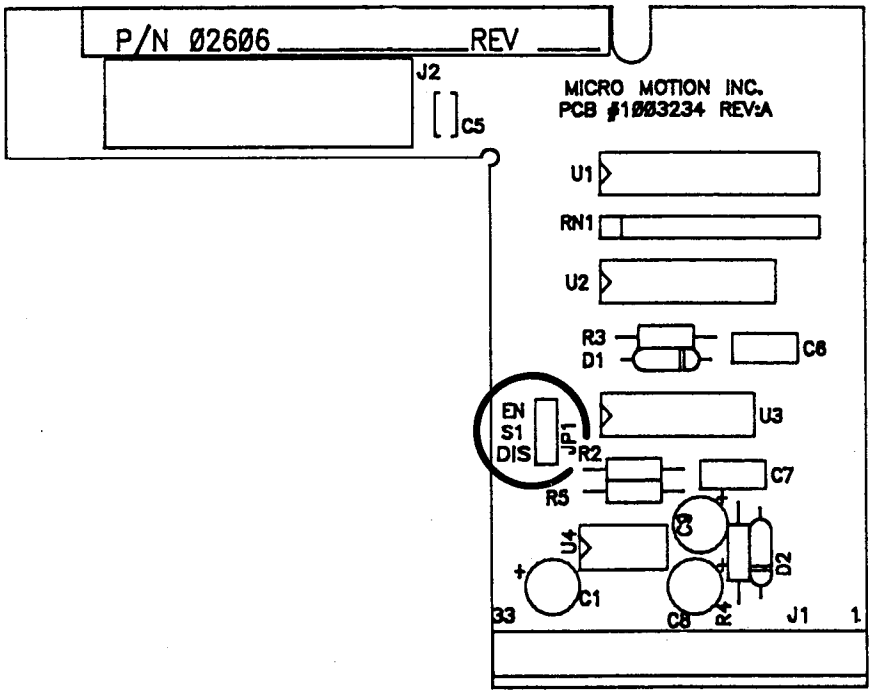
Note: The asterisk is displayed when the LED is "OFF" and the asterisk is not displayed when the LED is "ON".

4.6 Totalizer Reset Button Function (Local Display Option Only)

The optional totalizer reset button resets the internal totalizer of the RFT9712, as well as the total shown on the LCD. Pressing the button to the bottom of its travel and holding freezes the displayed total. Releasing the button then resets the total to zero.

The Local Display Option printed circuit card, attached to the inside of the upper cover of the RFT9712 (Figure 4-2), contains a jumper marked "JP1" which enables or disables the totalizer reset button. The reset button is enabled when the jumper is placed across pins "EN" and "S1." The jumper is set for enable when the transmitter is shipped from the factory. The reset button is disabled when the jumper is placed across pins "DIS" and "S1."

Figure 4-2
Location of Jumpers on the Display Option Interface Board



5 Troubleshooting

5.1 General Guidelines

A number of guidelines should be followed during the process of troubleshooting a Micro Motion flowmeter. Before beginning the diagnostic process, become familiar with the instruction manual applicable to the sensor. The manual provides detailed information about the sensor.

While troubleshooting a problem, leave the sensor in place, if possible. Problems often result from the specific environment in which the sensor operates. Next, check all signals under both flow and no-flow conditions. This procedure helps ensure that causes or symptoms won't be overlooked.

5.2 Symptom Definitions

Effective troubleshooting of a malfunctioning flowmetering system depends on accurate identification of failure symptoms. Once this identification is accomplished, the causes of failure can be eliminated. As previously stated, try to specify the problem in as much detail as possible. Here are the four main symptoms found in the field and their definitions:

No Output: There is flow through the sensor and no output is registered.

Unresponsive Output: Output remains constant while actual flow rate changes.

Erratic Output: Random changes in output are unrelated to changes in actual flow rate.

Intermittent Output: Output randomly stops and starts. Output, when present, accurately reflects the flow rate.

5.3 Interrogation With Model 268 SMART FAMILY® Interface

The SMART FAMILY Interface 268 is designed to assist with fault detection, diagnostics, and troubleshooting. The screen on the Model 268 displays messages pertaining to equipment problems or mistakes made in entering data. *Using the SMART FAMILY Interface 268 with the Micro Motion Remote Flow Transmitter* tells how to recognize and use fault-detection and diagnostics display messages.

Fault detection ensures the functional integrity of the sensor and the electronics, including the velocity transducers, drive coil, and RTD. Faults that do not manifest themselves in some obvious electrical form cannot be detected.

The RFT9712 runs continuous self-diagnostics. If these diagnostics reveal a failure, the screen on the Model 268 displays an error message. In addition, several tests check or adjust the output circuitry of the RFT9712.

With use of the Model 268, the following test features can be found under the test branch.

Analog Output Test

This test requires the RFT9712 to produce a desired current output of 2 to 22 mA. For more information, see Section 2.4.3, Loop Test, in *Using the SMART FAMILY Interface 268 with the Micro Motion Remote Flow Transmitter.*

Frequency Output Test

This test requires the RFT9712 to produce a desired frequency output of 1 to 10,000 Hz. For more information, see Section 2.4.3, Loop Test, in *Using the SMART FAMILY Interface 268 with the Micro Motion Remote Flow Transmitter.*

4 to 20 mA Output Trim

This feature allows trimming of the analog output. For more information, see Section 3.9.1, 4 to 20 mA Trim, in *Using the SMART FAMILY Interface 268 with the Micro Motion Remote Flow Transmitter.*

5.4 Wiring

The RFT9712 can be installed with up to 1000 feet of cable connected to 9-wire sensors or up to 500 feet of cable connected to 7-wire sensors. For detailed wiring instructions, refer to the instruction manual for the sensor.

Make resistance checks by removing the terminal strip from the terminal block and probing the corresponding terminal screws with the probes of a digital voltmeter. Wiring problems are often incorrectly diagnosed as a faulty sensor. The following should always be checked when the RFT9712 is first used:

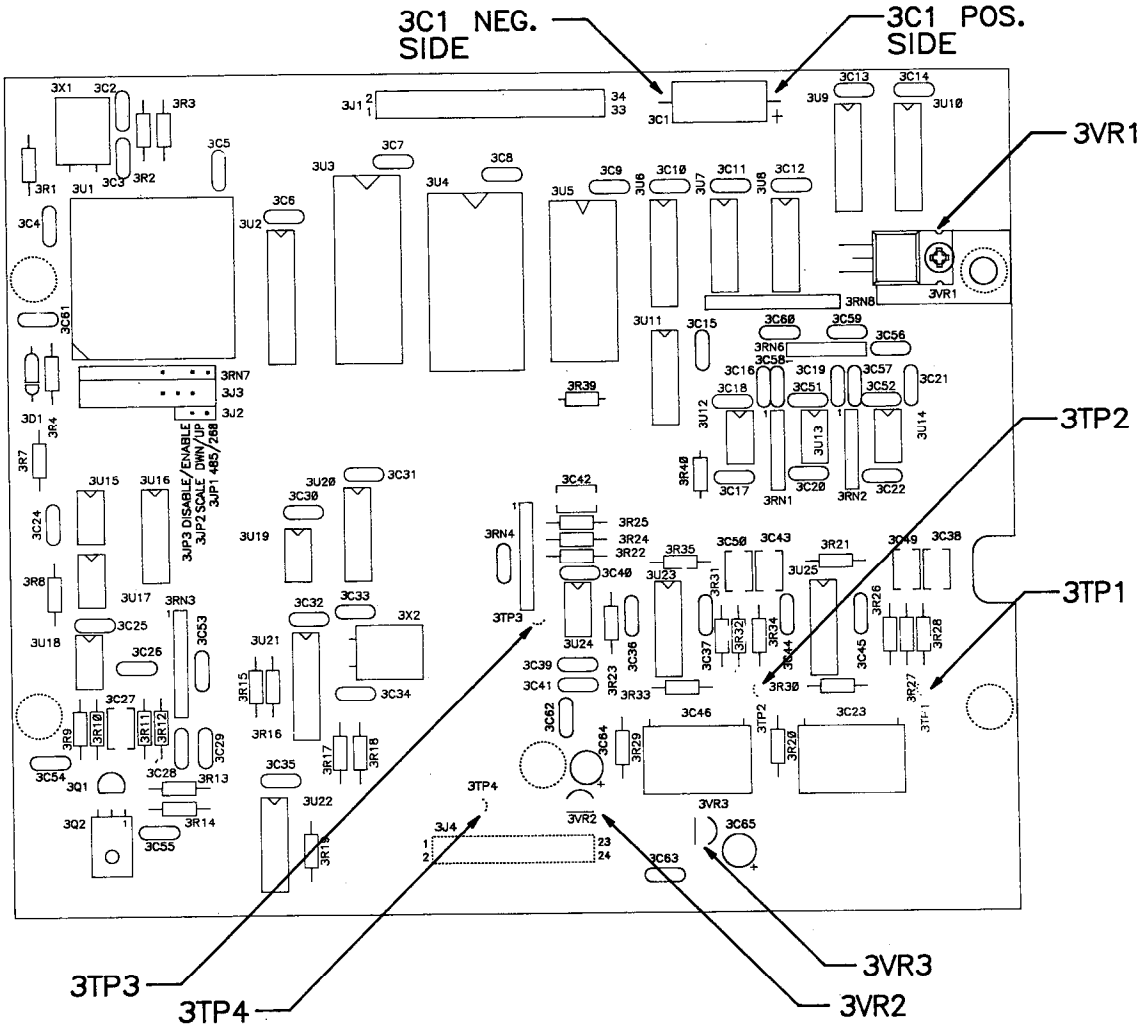
1. Proper cable; use of shielded pairs.
2. Proper wire termination.
   a. Wires on correct terminals.
   b. Wires making good connections with terminal strip.
   c. Wires making good connections at the sensor butt-splices or terminal strip.
   d. Wires properly connected at any intermediate terminal junction.

Check output wiring for proper connection. A load resistance of 250 to 1000 ohms must be present on the 4 to 20 mA output loop to enable use of the Model 268.

5.5 Internal Test Points

The RFT9712 integrates the analog signal from the position detector. Use test point 3TP1 to measure the right signal and 3TP2 to measure the left signal. Use test point 3TP4 to measure the drive control voltage. Table 1-2 lists specifications for the RFT9712. Figure 5-1 shows the location of test points on the processor board.

Figure 5-1
Location of Test Points on the Processor Board



Test Points (negative side of 3C1 is the reference ground):

3TP1 11 VAC peak-to-peak (approximately 3.7 RMS). Frequency dependent upon meter size and process fluid.
3TP2 11 VAC peak-to-peak (approximately 3.7 RMS). Frequency dependent upon meter size and process fluid.
3TP4 0.6 to 9 VDC (normal operation). Greater than 10 VDC (saturation voltage).

Power Supply (negative side of 3C1 is the reference ground):

3C1 5 VDC

Terminal Signal Specifications
Terminals

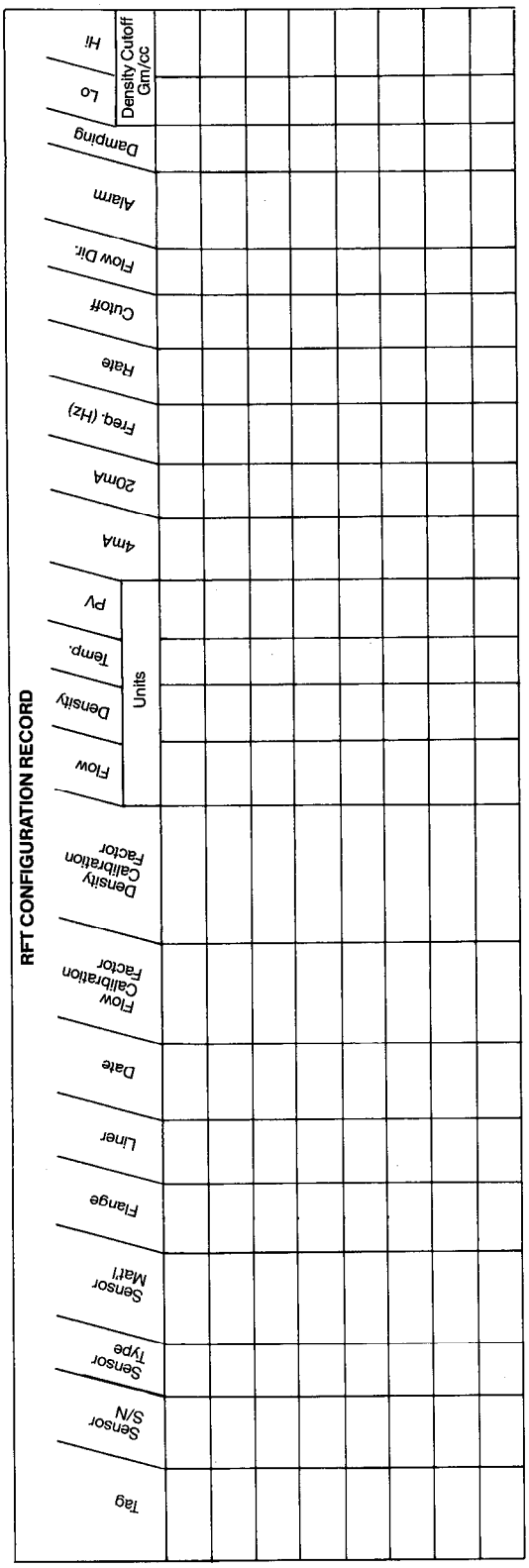
1 to 2	Drive Signal; 1.2 to 20 volts peak-to-peak
3 to 4	Lead Length Compensator; 10 mVDC maximum
5 to 4 or 5 to 9	Left Position Detector; 300 mV AC peak-to-peak sine wave, 0.095 VAC RMS (150 mV peak-to-peak for D600)
6 to 4 or 6 to 8	Right Position Detector; 300 mVAC peak-to-peak sine wave, 0.095 VAC RMS (150 mV peak-to-peak for D600)
7 to 4	Temperature Sensor, 35 mVDC at 0°C, +0.14 mVDC/°C
11 to 12	Input Line Voltage (user supplied voltage)
15 to 14	Remote Zero Set (pull-up to 5 VDC)
17 to 16	4 to 20 mA Output
19 to 18	Frequency Output; 15 VDC peak-to-peak square wave
21 to 22	RS-485 I/O, ±5V
24 to 23	Tube Temperature Output; 5 mV/°C
25 to 23	Tube Period Output; 2.5 VAC RMS
26 to 18	Flow Direction Signal; 15 VDC w/fwd, and 0 VDC w/rev.

Values are approximate.

5.6 Customer Service

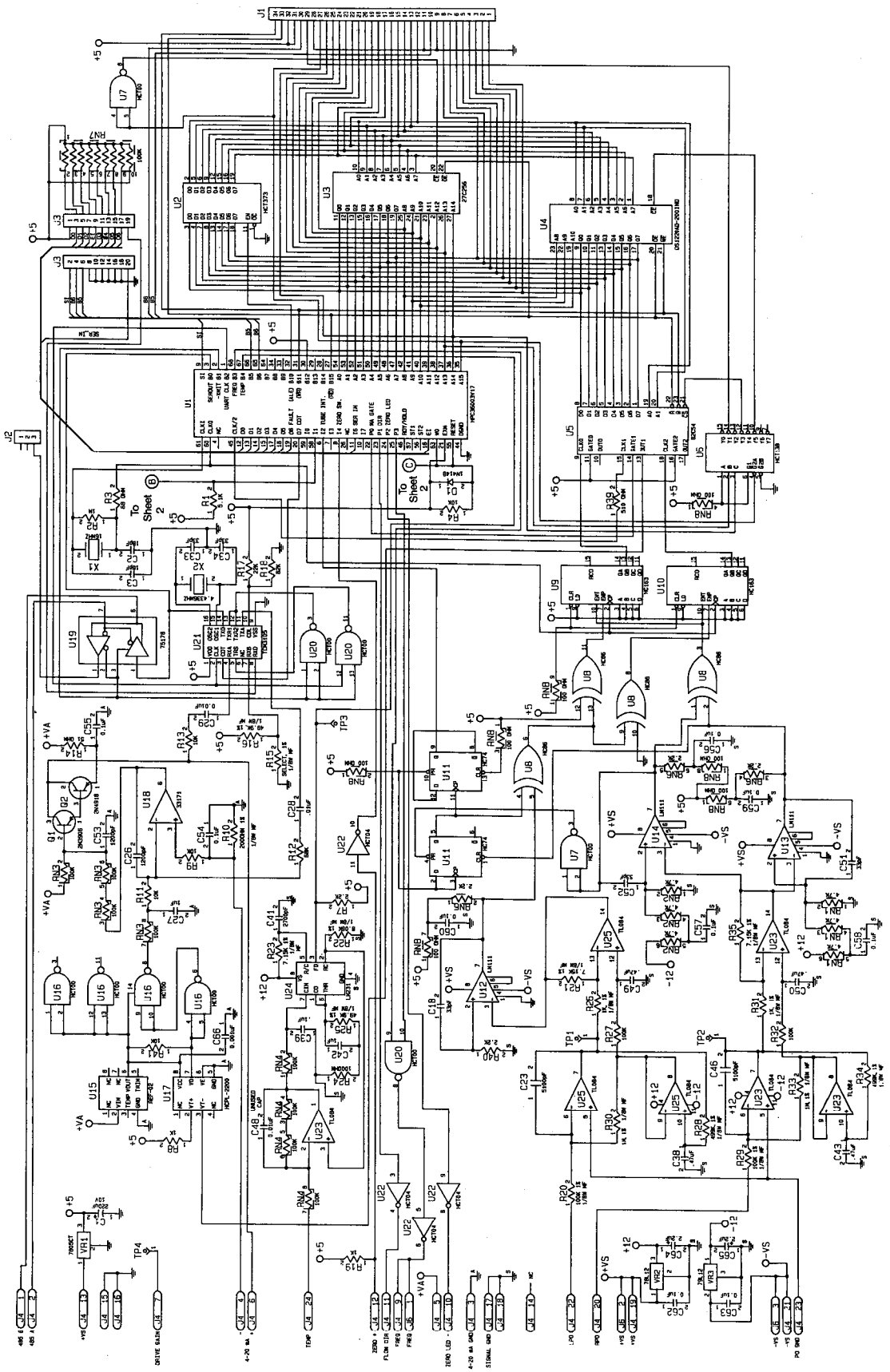
For toll-free, 24-hour assistance, phone the Micro Motion Customer Service Department at 1-800-522-MASS (1-800-522-6277).

Appendix I RFT9712 Configuration Record



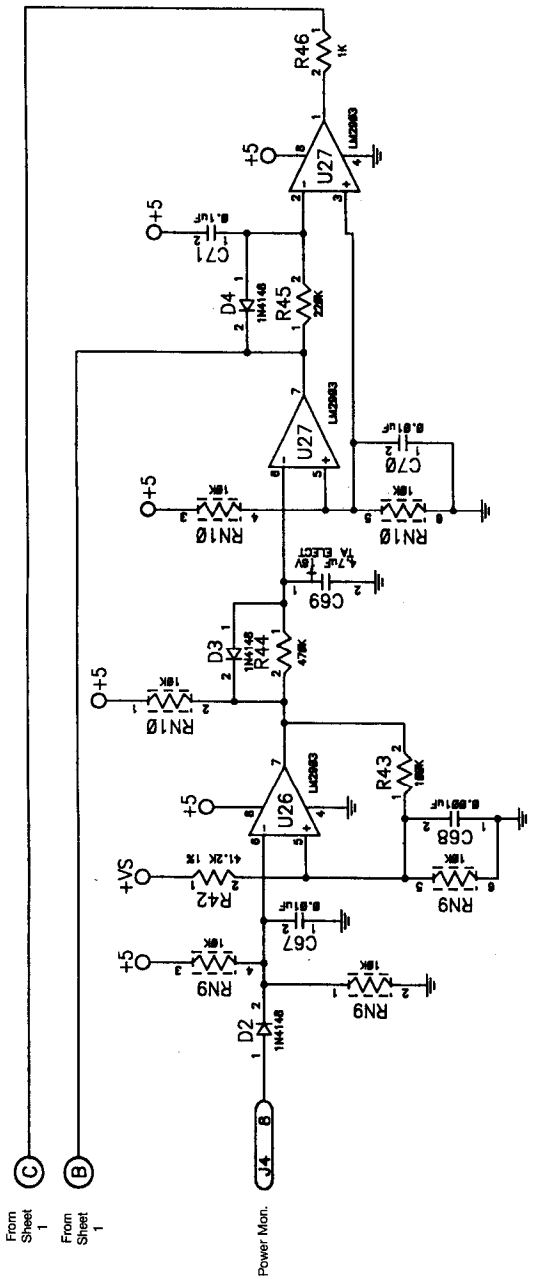
Appendix II RFT9712 Board Schematics

Processor Board, Sheet 1



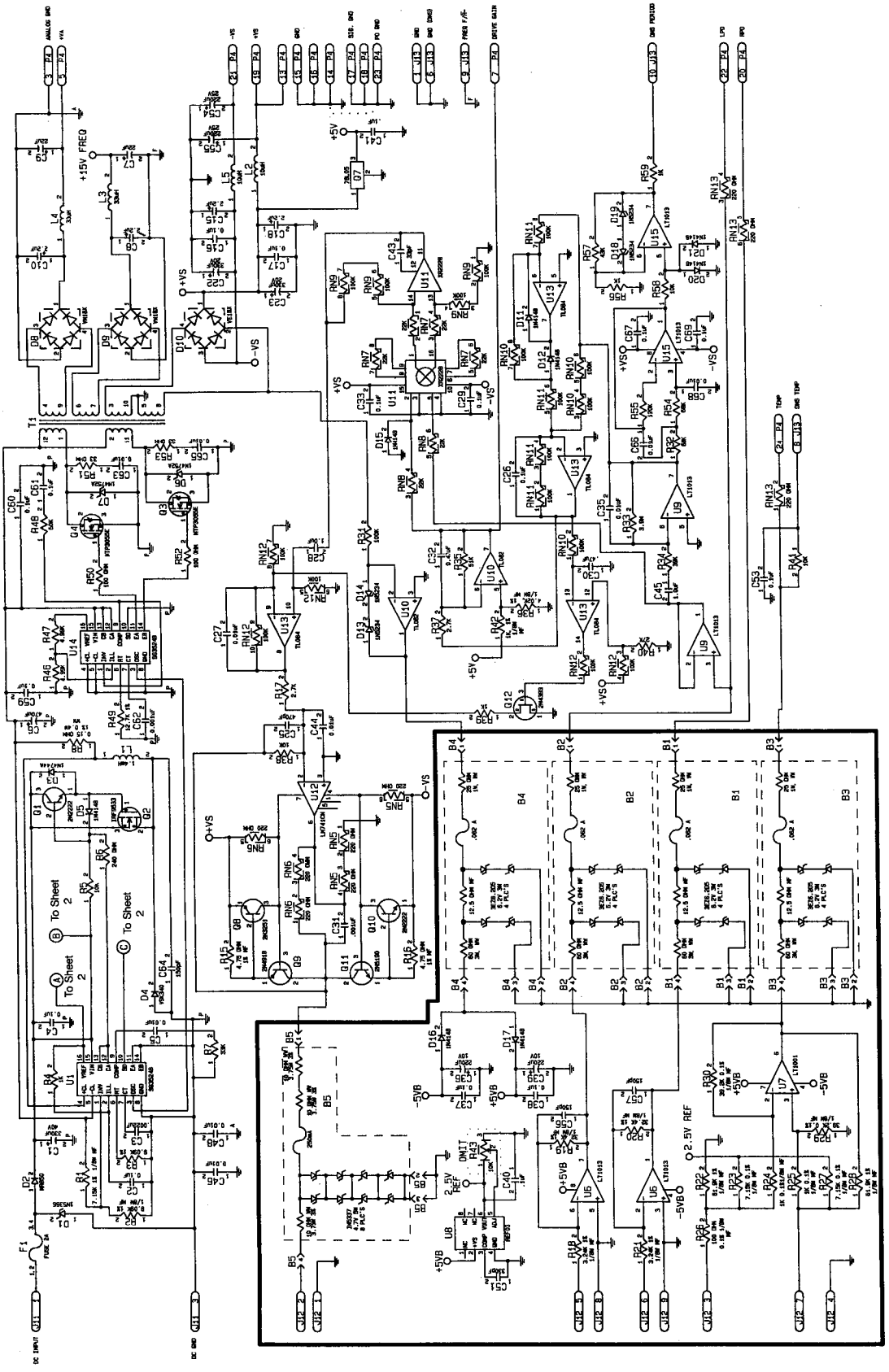
Appendix II RFT9712 Board Schematics

Processor Board, Sheet 2



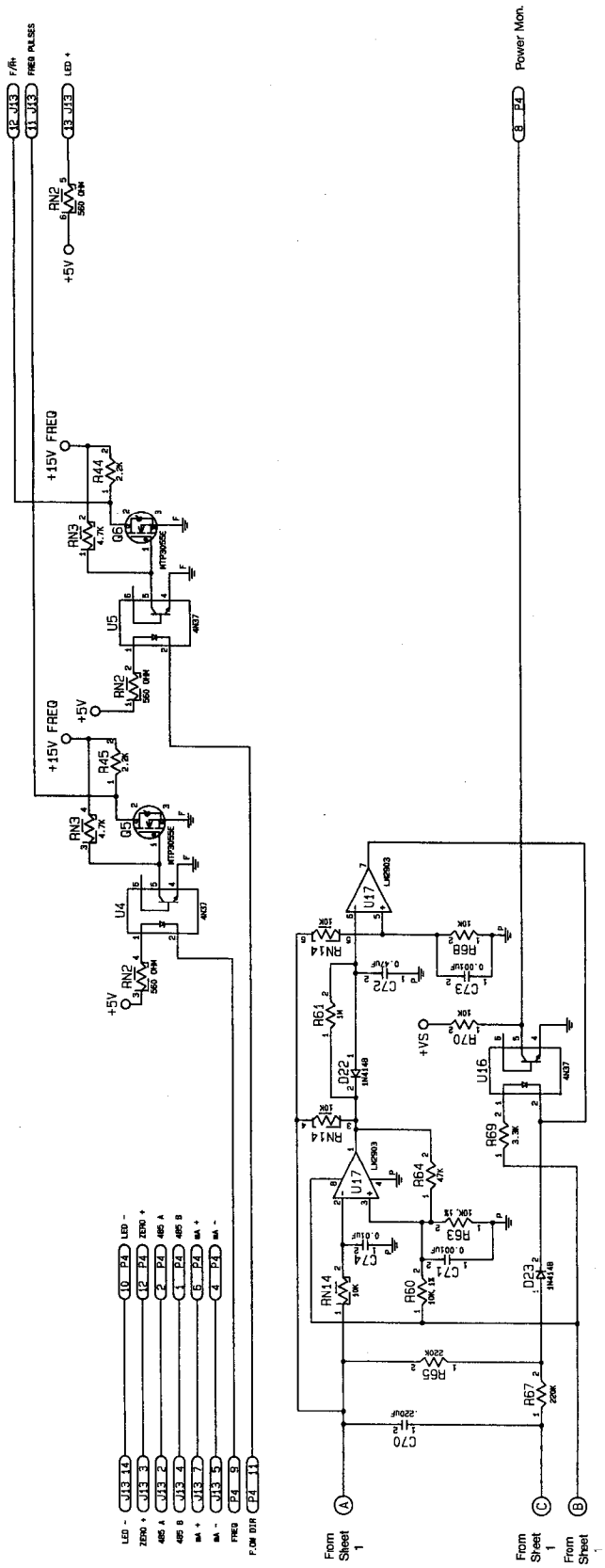
Appendix II RFT9712 Board Schematics

Drive Board, Sheet 1



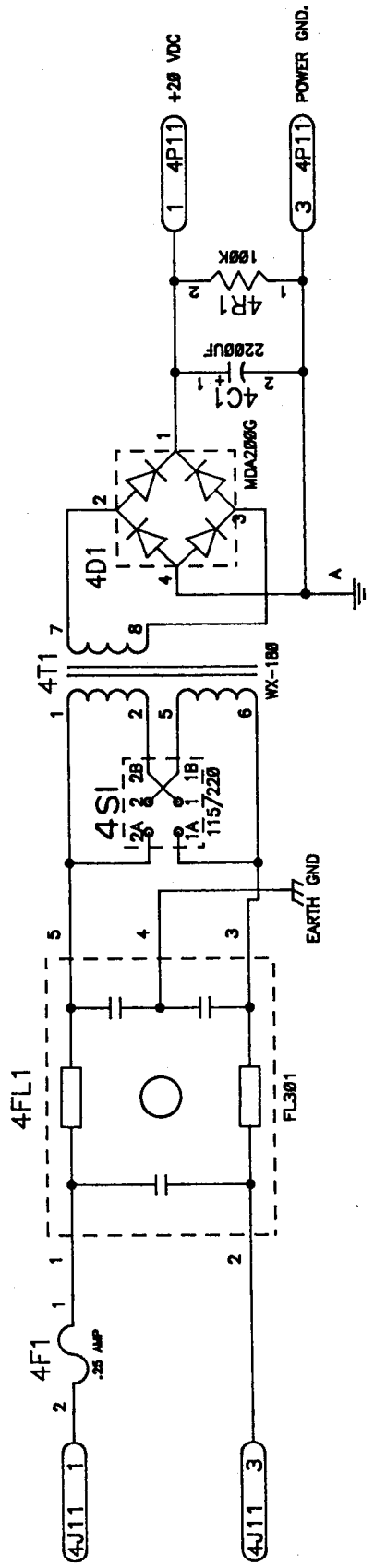
Appendix II RFT9712 Board Schematics

Drive Board, Sheet 2



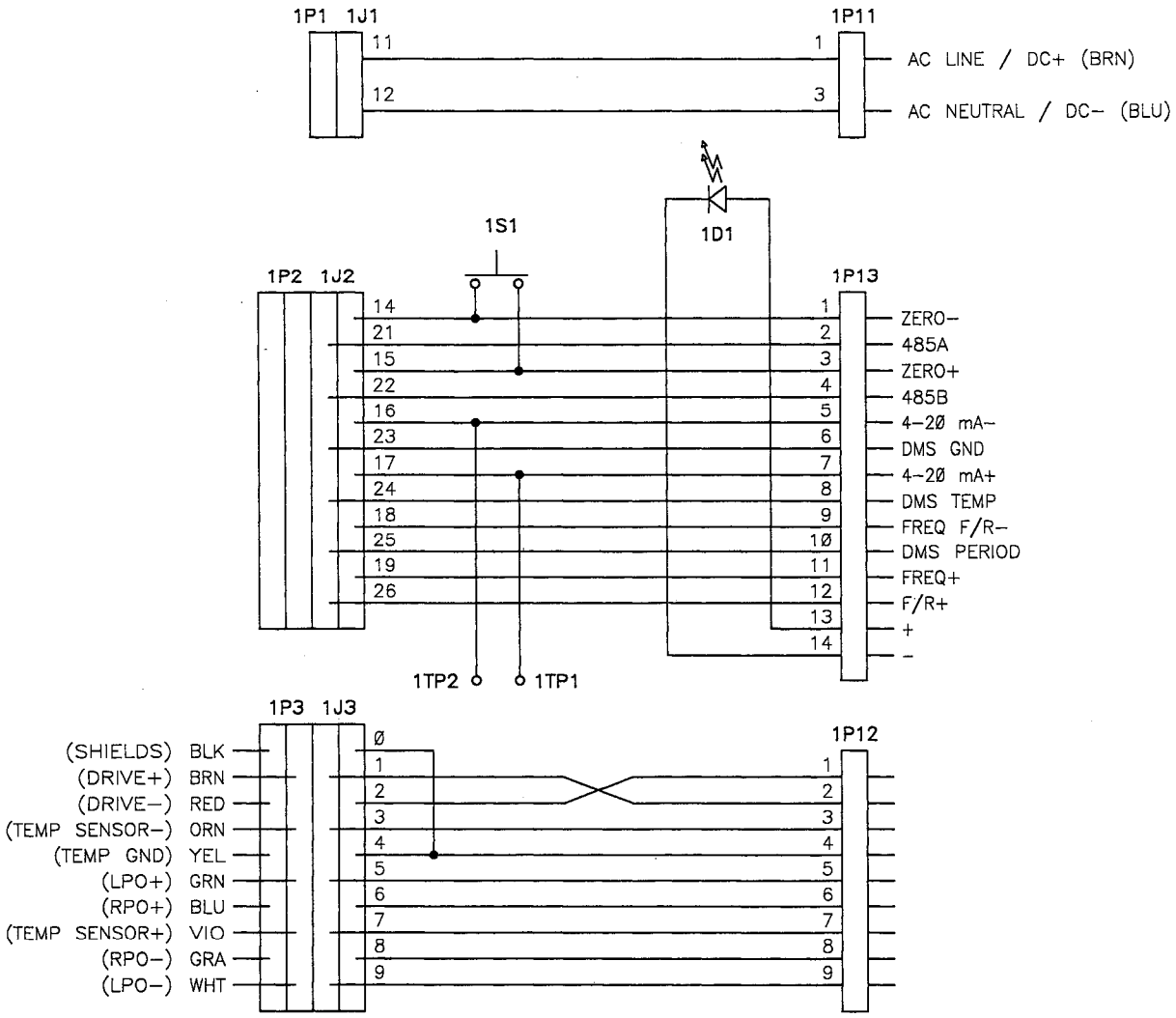
Appendix II RFT9712 Board Schematics

115/230 VAC Power Board



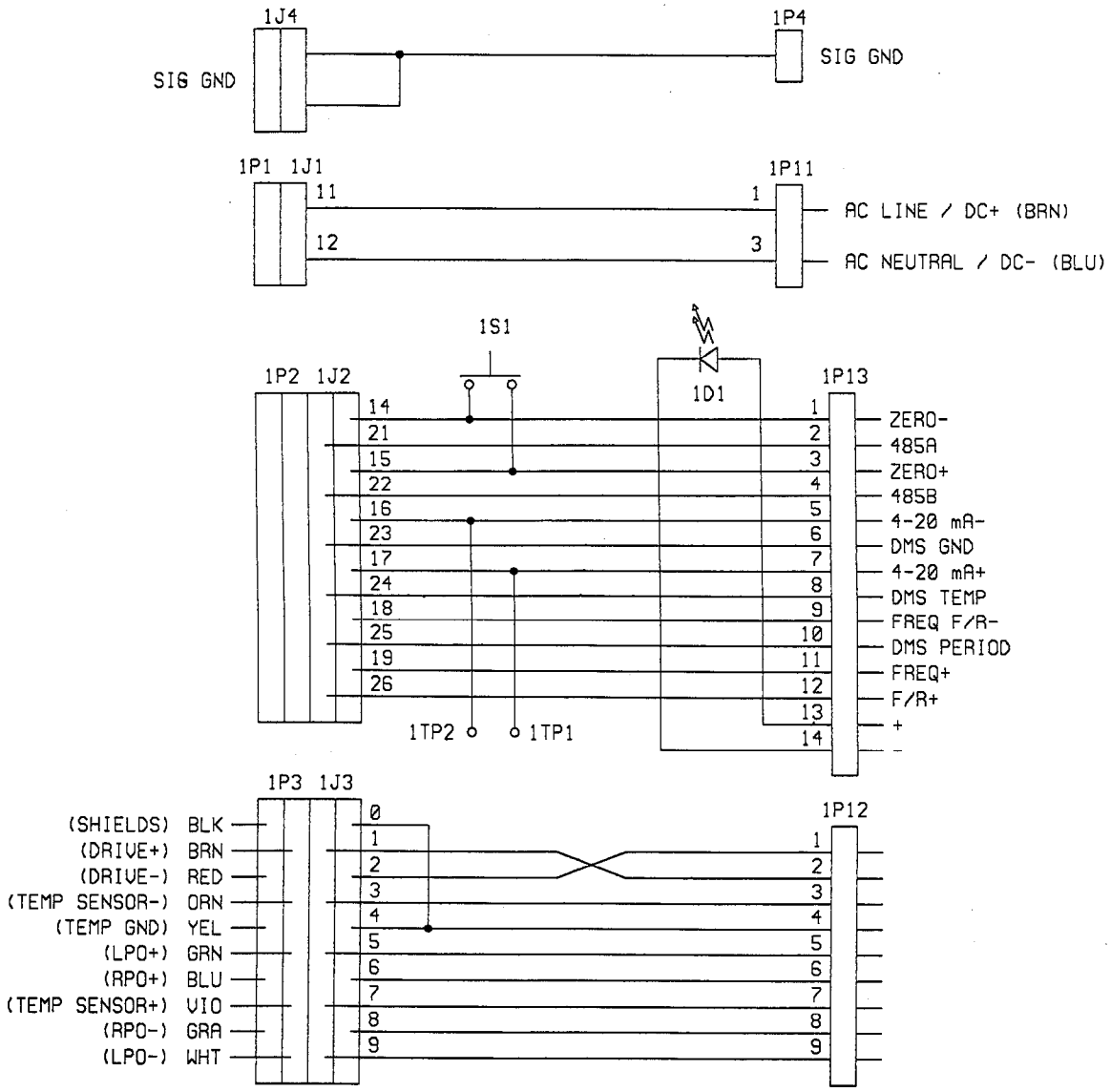
Appendix II RFT9712 Board Schematics

Terminal Board



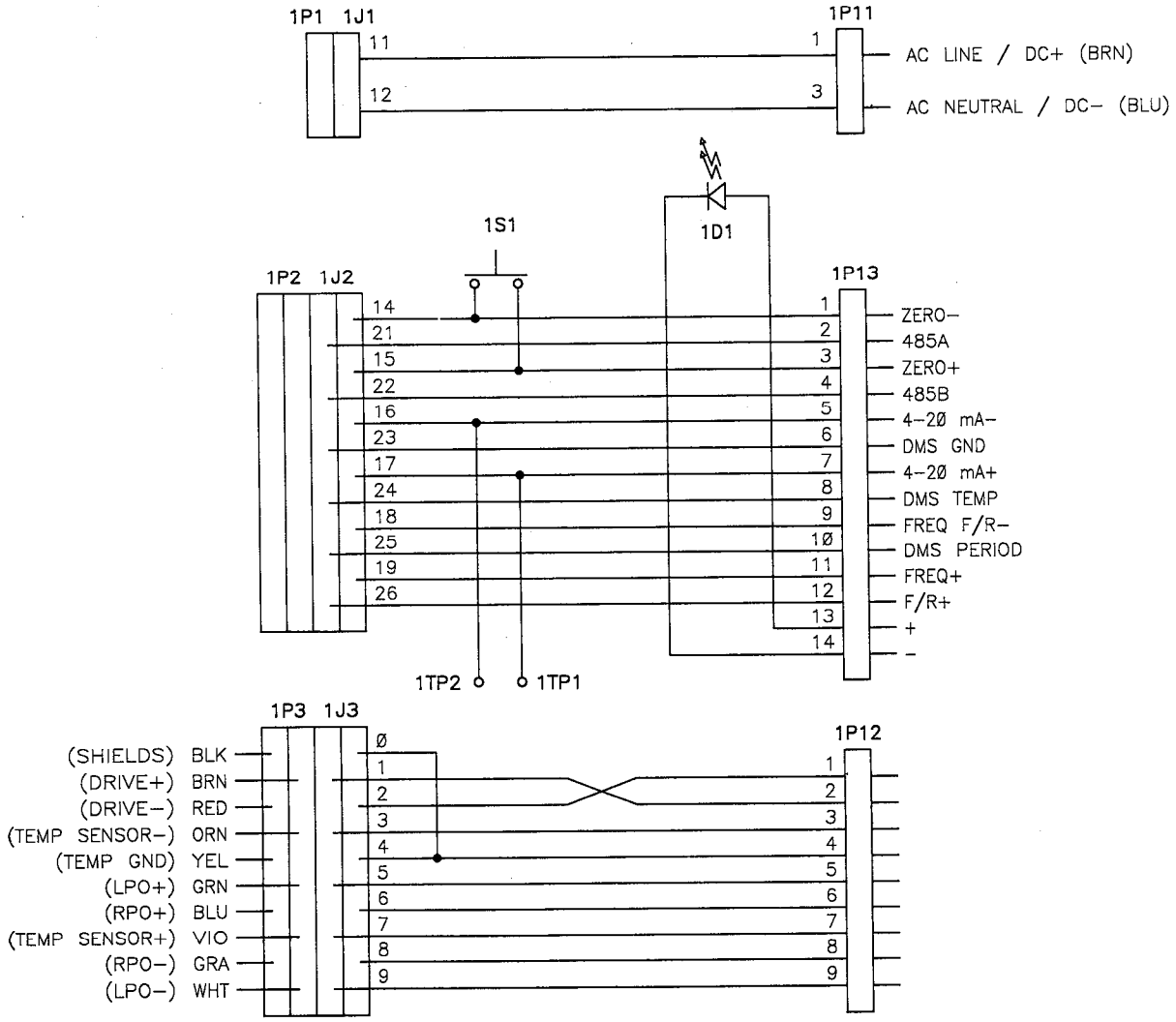
Appendix II RFT9712 Board Schematics

Terminal Board, Signal Ground



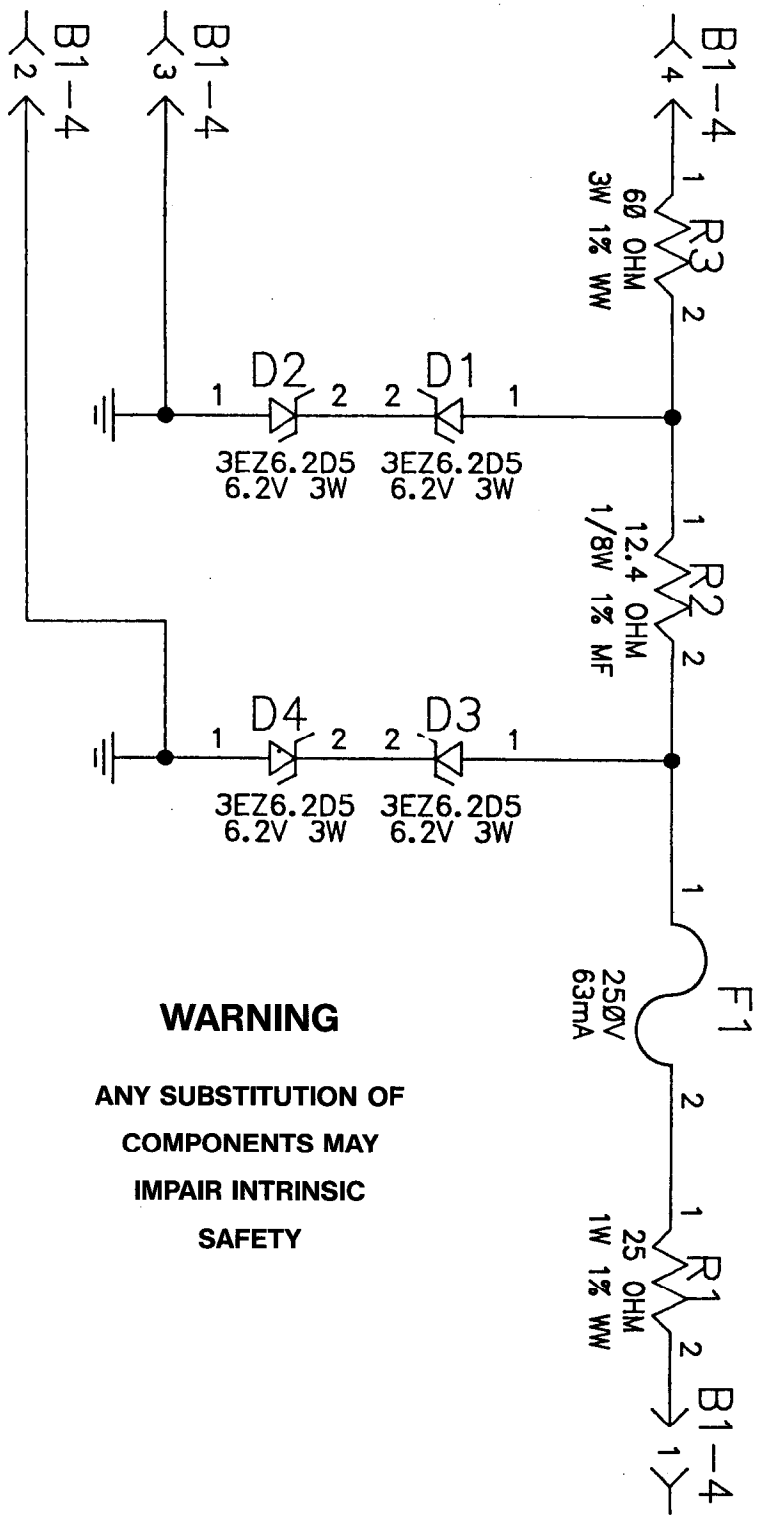
Appendix II RFT9712 Board Schematics

Terminal Board, SAA



Appendix II RFT9712 Board Schematics

Signal Barrier Board

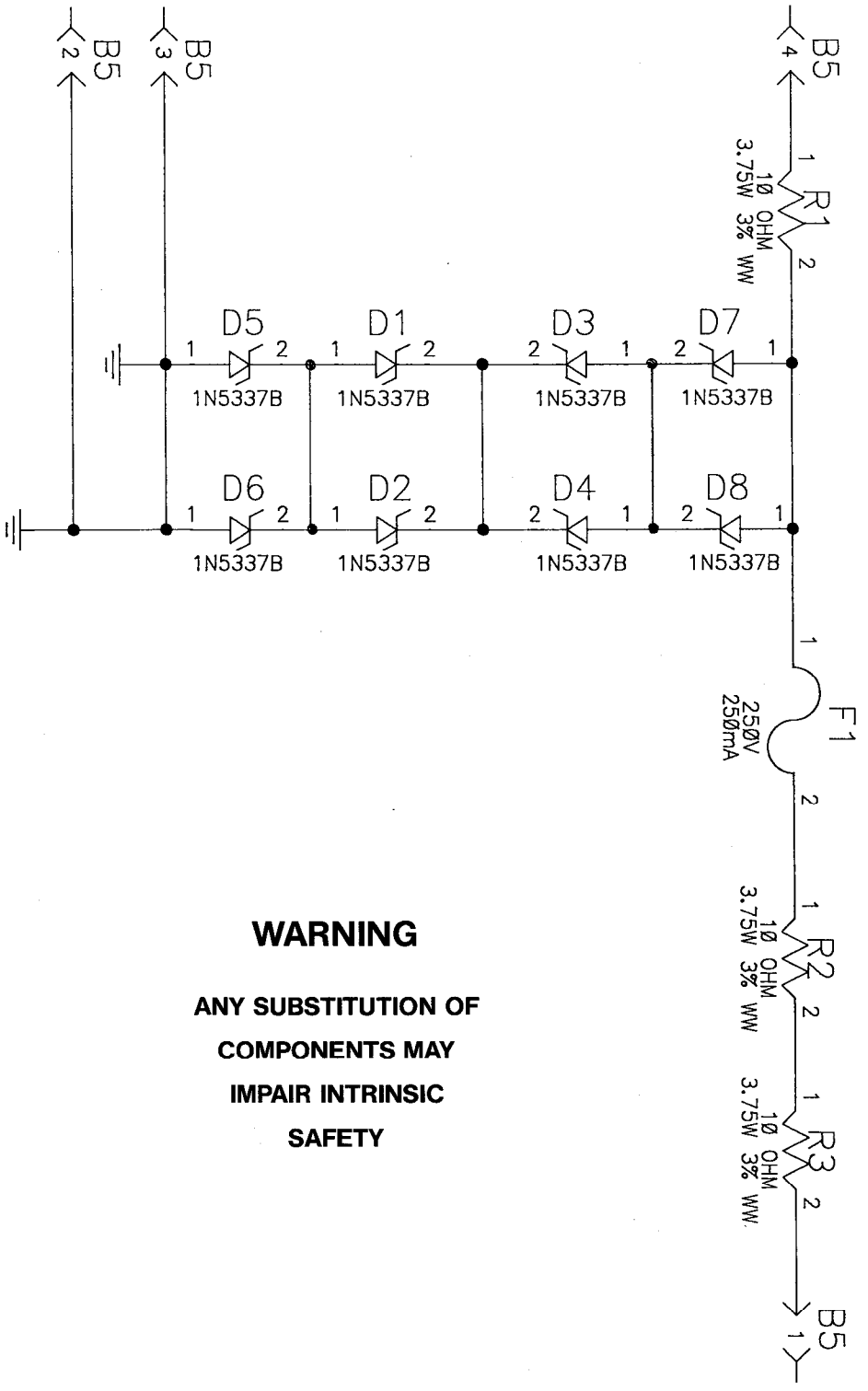


WARNING

ANY SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY

Appendix II RFT9712 Board Schematics

Drive-Barrier Board

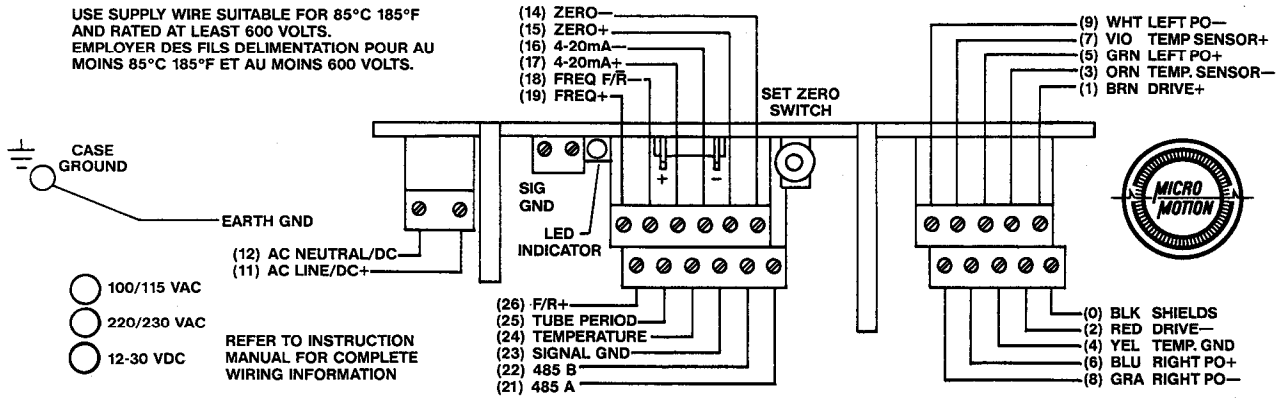


WARNING

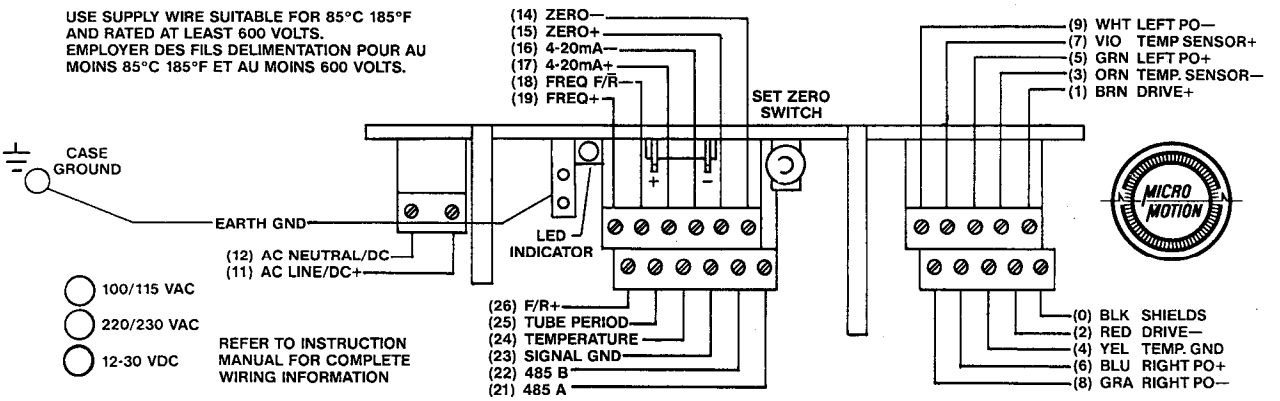
ANY SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY

Appendix III Terminal Connection Labels Inside the RFT9712 for SAA and Isolated Ground Versions

Isolated Signal Ground



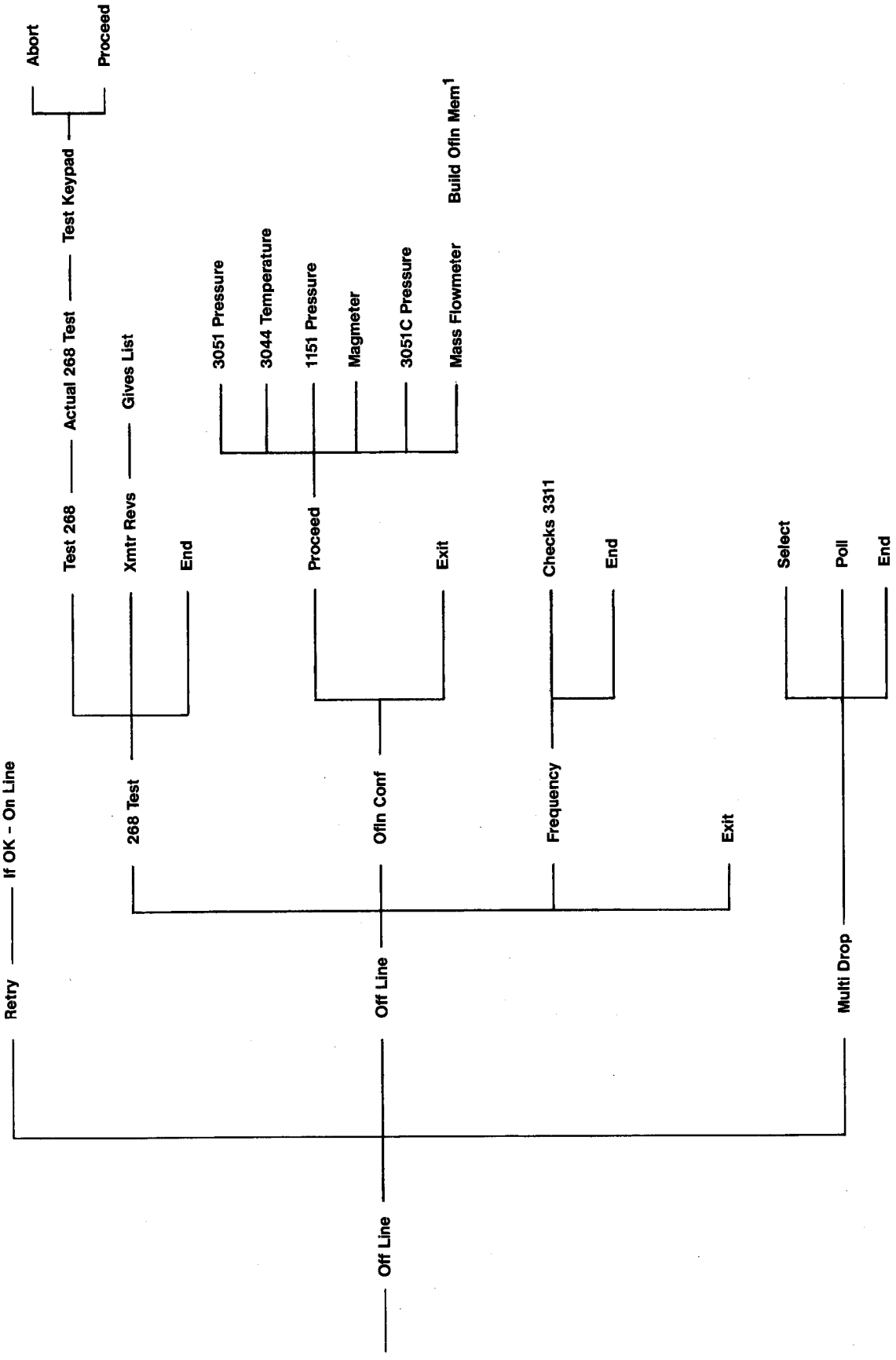
SAA



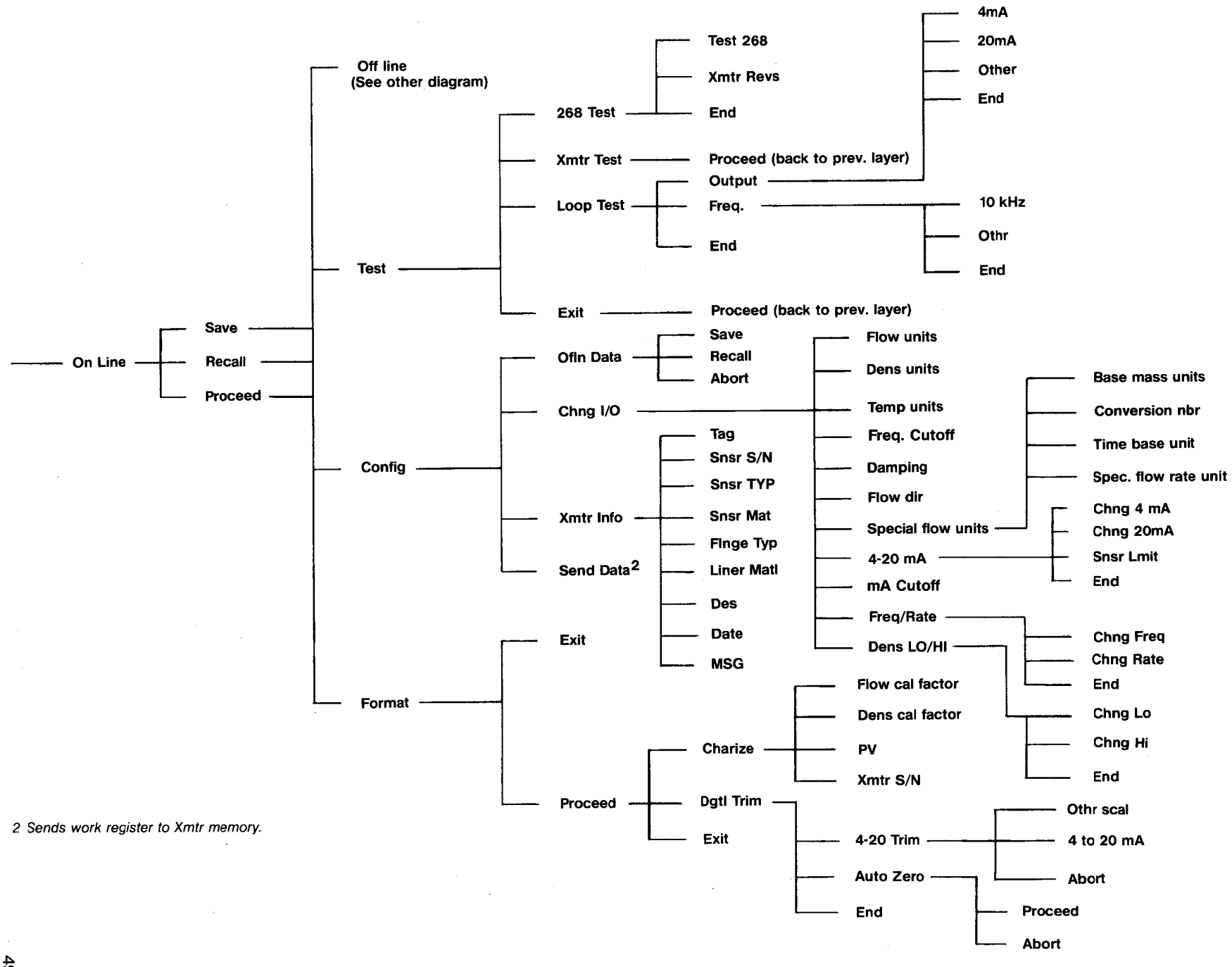
Appendix IV Model 268 SMART FAMILY® Interface Flow Diagram

Operation of Model 268 SMART FAMILY™ Interface with Micro Motion RFT9712

The 268 software is organized by layers. The "On Line" diagram shows six vertical layers from left to right, starting with Save, Recall, and Proceed. Follow the lines and keystrokes to get a desired function. Should you wish to go back one layer, you must use the PREVIOUS FUNCTION key.



1 Continued on next page under Chng I/O and Xmtr Info.



2 Sends work register to Xmtr memory.

List of Micro Motion® Instruction Manuals

Sensors:

ELITE™ Sensor Instruction Manual, 2-92, Rev. B, P/N 3001211
Model D Sensor Instruction Manual, 5-91, Rev. A, P/N 1003467
Model DL Sensor Instruction Manual, 12-90, Rev. C, P/N 1002318
High Temperature Sensor Instruction Manual, 1-90, Rev. B, P/N 1002278

Transmitters:

ELITE™ Model RFT9739 Field-Mount Transmitter Instruction Manual,
2-92, Rev. B, P/N 3001210
ELITE™ Model RFT9739 Rack-Mount Transmitter Instruction Manual,
10-91, Rev. A, P/N 3001217
Model RFT9712 Remote Flow Transmitter Instruction Manual, 1-91, Rev. A, P/N 1003349
FlowScale® System Instruction Manual, 1-90, Rev. B, P/N 1002550
Remote Electronics Unit Instruction Manual, 4-89, Rev. A, P/N 1002337

Communications:

Using the SMART FAMILY® Interface 268 with the Micro Motion ELITE™ Model RFT9739 Transmitter,
1-92, Rev. A, P/N 3001215
Using the SMART FAMILY® Interface 268 with the Micro Motion Remote Flow Transmitter,
10-90, Rev. B, P/N 1002657
Using Modbus® Protocol with the Micro Motion ELITE™ Model RFT9739 Transmitter,
10-92, Rev. B, P/N 3001216
Using ProLink™ Software with Micro Motion 9700 Series Transmitters, 11-92, Rev. A, P/N 3001506

Peripheral Products:

DMS Density Monitoring System Instruction Manual, 9-88, Rev. C, P/N 1001280
DRT Digital Rate Totalizer LCD Instruction Manual, 7-90, Rev. C, P/N 1001421
DRT Digital Rate Totalizer LED Instruction Manual, 9-90, Rev. D, P/N 1000618
FMS-3 Flow Monitoring System LCD Instruction Manual, 7-90, Rev. C, P/N 1001316
FMS-3 Flow Monitoring System LED Instruction Manual, 7-90, Rev. B, P/N 1000558
Net Oil Computer Instruction Manual, 5-92, Rev. A, P/N 1003671
NFC Net Flow Computer Instruction Manual, 12-90, Rev. A, P/N 1003326

Wiring Instructions:

Installation Instructions TYPE UL-D-IS, 12-91, Rev. F, P/N 1002648
Installation Instructions TYPE CSA-D-IS, 12-91, Rev. D, P/N 1003328
Installation Instructions TYPE SAA-D-IS, 5-91, Rev. D, P/N 1003210

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