Operating instruction manual OI/RI100-EN Rev. F

RI100
Level Measurement Accessory

Repeat Indicator

K-TEK Level products

Introduction

This operating instruction manual provides the following information:

– Installation instructions - see page 6
– Setup and operation - see page 7
– Troubleshooting - see page 14
– Typical wiring diagram - see page 15

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For the most current information regarding the ***RI100*** or other ABB Products, visit our website at www.abb.com/level.

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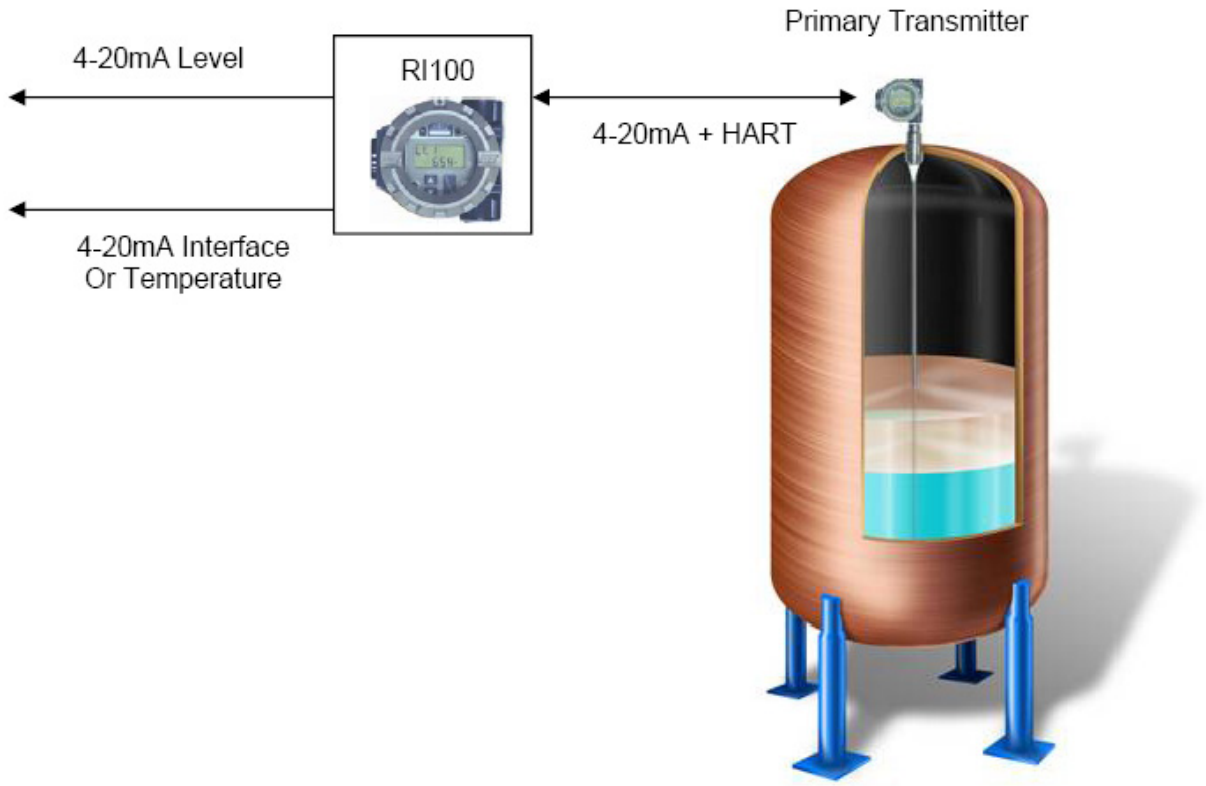
1.0 PRINCIPLE OF OPERATION

The RI100 is a 2 wire loop powered device designed to act as a secondary device to Magnetostrictive and Guided wave Radar transmitters. It operates by gathering information from its Primary Transmitter using HART communication then processing the received information into a 4-20mA output. The RI100 does not have a sensor. The information it processes must come from the sensor on the Primary Transmitter. When the Primary Transmitter is powered, it will run a start up routine, begin measuring, then return a 4-20mA output. When the RI100 is powered it also runs a start up routine which consists of establishing communication with the Primary Transmitter and retrieving the set up data from it. This data contains the trim dimensions, the number of measured variables, the calibration range of each variable, and the up to date measurement of each of the variables. Once the data is read, the RI100 will continue to communicate with the Primary Transmitter, receiving updates on the measured variables and calibration range of the Primary Transmitter. As a secondary device, changes made to the information in the RI100 will not affect the Primary Transmitter. Changes made to the information in the Primary Transmitter will affect the RI100.

The communication between the RI100 and the Primary Transmitter is achieved through an isolation board mounted in the back of the RI100 housing. The isolation board allows the loop of the Primary Transmitter and the loop of the RI100 to interact with each other while not affecting the operation of each other. The isolation board is connected to the terminal strip of the RI100 and holds a second terminal strip for a connection to the Primary Transmitter loop.



2.0 GENERAL INFORMATION

A. Storage Information

Storage prior to installation should be indoors at ambient temperature, not to exceed the following:

- Temperature range: -40° to 150°F
- Humidity: 0 to 100% R.H. non-condensing

B. Ambient Temperature

The RI100 electronics temperature may not exceed 170°F / 77°C.

3.0 INSTALLATION

A. Mechanical Installation

The RI100 is equipped with it's own mounting bracket. The bracket is attached to the housing using (2) 1/4-20 set screws and comes with a "U" bolt that fits a 2" pipe. With the attached bracket and "U" bolt the RI100 may be mounted on a pipe stand. The accompanying bracket may be removed to attach the RI100 housing directly to a uni-strut or angle iron stand.

The location of the RI100 in relation to the primary transmitter electronics will be determined by the type and size of wire used in the electrical connection. Refer to publications on www.hartcomm.org for the latest regarding wire type, size and distance to transmitter. As a general rule, the RI100 should be mounted within 50 feet (15.2 meters) of the Primary Transmitter when wired with 18 AWG twisted, shielded cable.

B. Electrical Installation

1. RI100

Note: The RI100 is not intended for intrinsically safe installations.
Install conduit to 3/4" NPT port and run 18 gauge twisted, shield pair to housing, Refer to wiring diagram ELE1004 page 14 for typical loop wiring.

The terminal side of the RI100 contains two terminal strips, a 3 position and a 2 position. The 3 position terminal strip will be referred to as Terminal 1 and the 2 position as Terminal 2.

Apply loop power to the RI100 as follows:

Terminal 1+	14 VDC minimum to 36 VDC Maximum
Terminal 1-	To control System Input
Ground Screw	GROUND

**The "+Meter" and "-Meter" terminals are available to hook up a mA meter to monitor loop current, without breaking the loop (see Figure 1 on page 6).*

3.0 INSTALLATION

2. Primary Transmitter

Install conduit to 1/2” NPT port and run 18 gauge twisted, shielded pair to housing. Refer to wiring diagram ELE1004 page 15 for typical loop wiring.

In order for the RI100 to communicate with the transmitter it is monitoring, the Primary Transmitter loop wiring must be connected to Terminal Block 2 on the isolation board of theRI100. This connection will be in parallel to the loop wiring of the Primary Transmitter.

Terminal 2 + Primary Transmitter +
Terminal 2 - Primary Transmitter -

NOTE: To establish HART communication between the Primary and the RI100, each loop should contain a 250 ohm resistor.

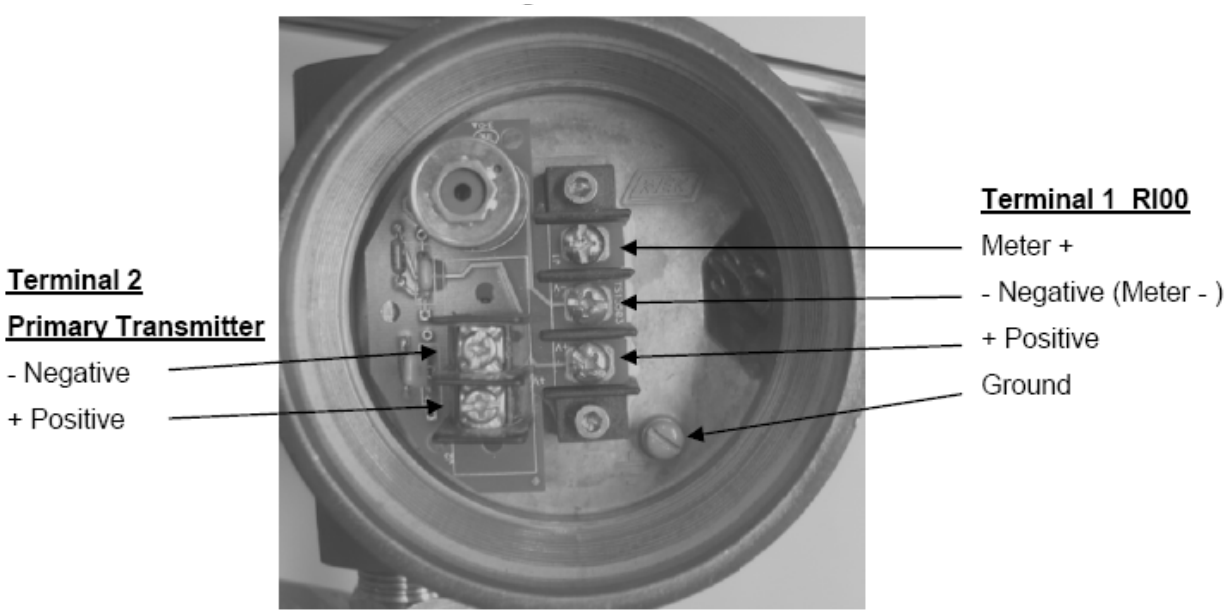


Figure 1

4.0 SETUP AND OPERATION

A. Jumper Switch Settings

The jumper switches are located on the face of the electronics module and can be set up as follows (**Figure 2**).

Alarm (Left Jumper)

- Placing the jumper to the lower position causes the output to go to 21.00 mA when there is a loss of signal or transmitter malfunction.
- Placing the jumper to the upper position causes the output to go to 3.61 mA when there is a loss of signal or transmitter malfunction.
- **Note:** For a change in setting to go into effect transmitter power needs to be turned OFF then back ON.

Write Protect (Right Jumper)

- When the jumper is in the lower position the transmitter configuration cannot be changed from the setup menu. (**Figure 2**).
- **Note:** For a change in setting to go into effect transmitter.

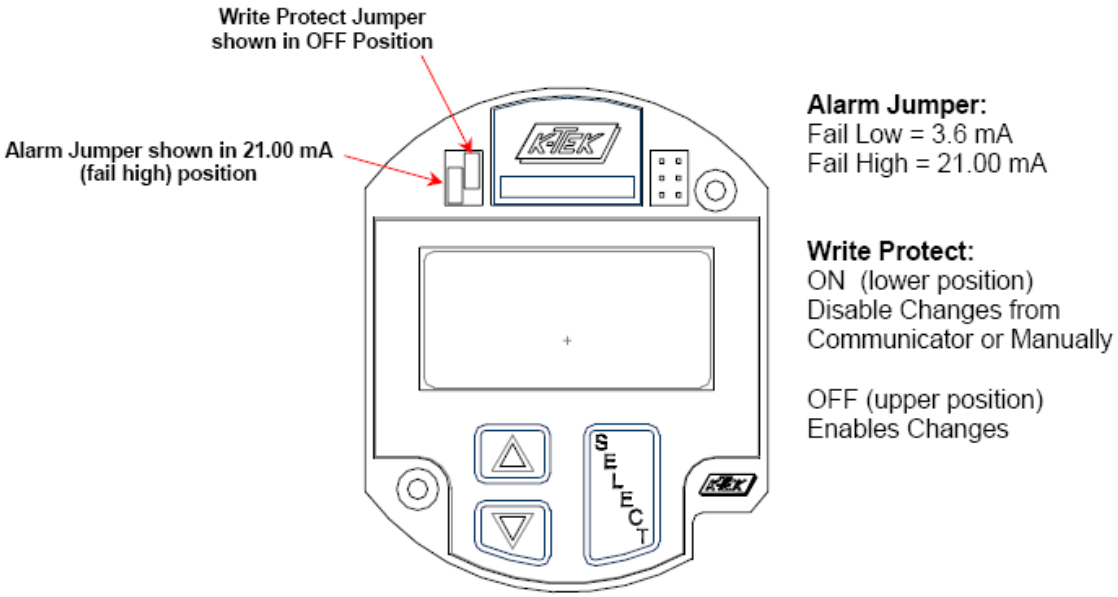
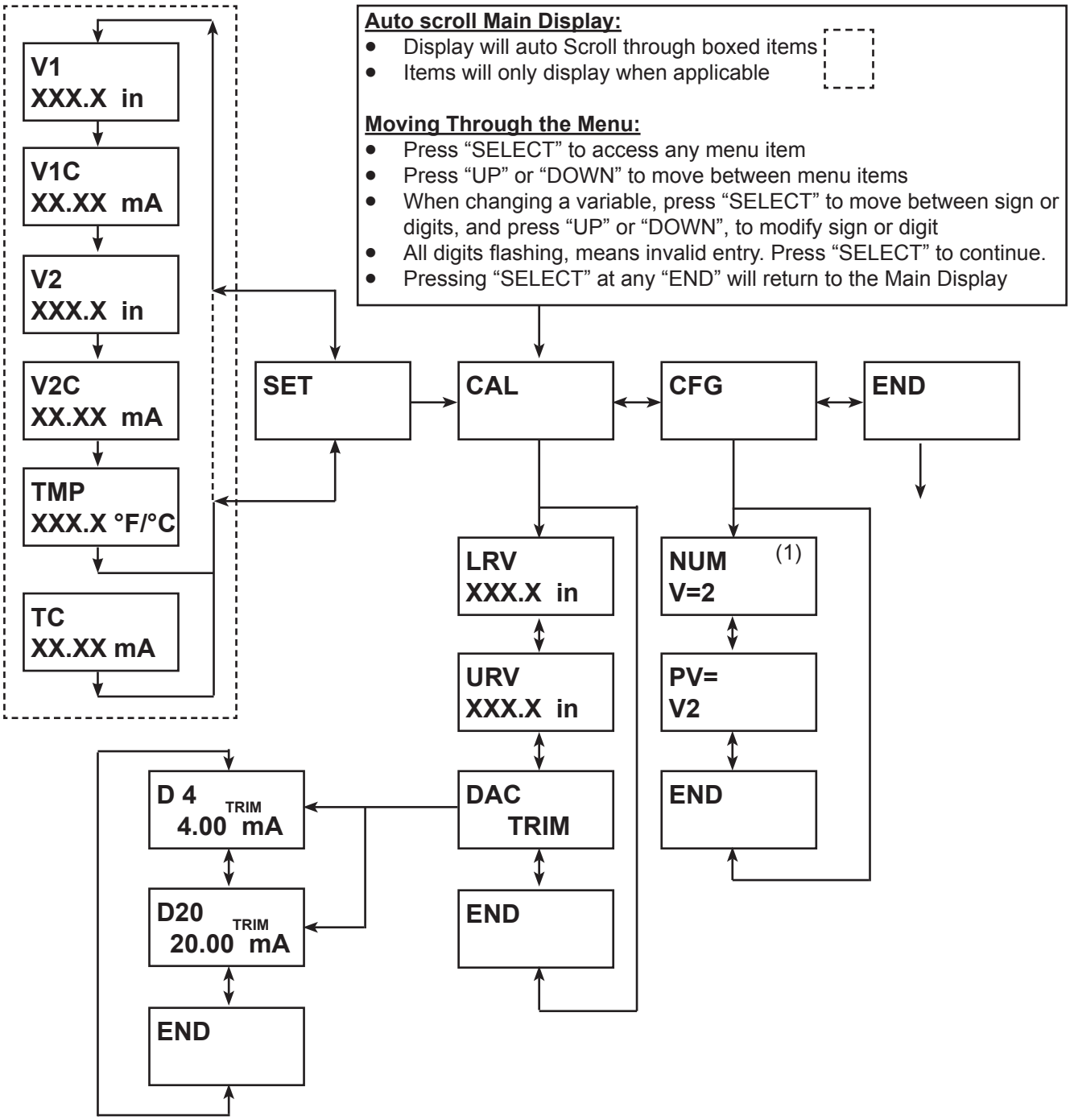


Figure 2

4.0 SETUP AND OPERATION

B. RI100 Menu Flow Chart



(1) Only displayed when RI100 is NOT in communication with a primary transmitter on power up.

4.0 SETUP AND OPERATION

C. Interface Applications (M4B or M5B modules):

a. PV= (V1 or V2) selects which variable, primary (V1) or secondary (V2), coming to the RI100 via HART protocol from the primary transmitter will be represented on the RI100's 4-20mA output.
b. V1 is ALWAYS the value (LL1 or LL2; total or interface level) that the primary transmitter has selected for its 4-20 mA output.
c. V2 is ALWAYS the value (LL1 or LL2; total or interface level) that the primary transmitter has NOT selected for its 4-20 mA output.

Note: LL1 is ALWAYS the level (total or interface) that is CLOSEST to the primary transmitter's head. This is:

1. Total level for AT100; top mounted AT200
2. Interface level for bottom mounted AT200

d. RI100 should always be set for PV=V2 for interface applications.
e. Should PV=V1 be selected on the RI100, the RI100's 4-20mA output will simply "repeat" the primary transmitter's 4-20mA output.
f. It is recommended that:

1. The primary transmitter's PV= LLx should be set for the total level; leaving,
2. The primary transmitter's secondary variable for the interface measurement.
3. RI100 will be set PV=V2, which will set it's 4-20mA output for the interface measurement.

D. Temperature (Primary Transmitter must have an M5A or M5B module):

a. RI100 CFG Menu; PV= (Scroll to and select) TEMP
b. TEMP is the Digital Temperature Variable from the Primary Transmitter

1. Temp scale (F/C) is selected from CFG menu on the Primary Transmitter;
2. Range must be set on RI100 LRV; URV.
3. If temperature is not correct,
    a.) It can be trimmed from the CAL menu on the Primary Transmitter
    b.) Temperature can be reset to factory calibration from the CFG menu on the Primary Transmitter.

E. Notes and Comments:

a. On any of the transmitters, both primary and the RI100, the variable that is selected for the 4-20 mA signal can easily be determined by setting the module to "SCROLL" (press select button one time to enter scroll function) and observe which of the variables shows the current output; i.e. L1C, L2C, TC (if temperature is available).

4.0 SETUP AND OPERATION

F. Definitions of Menu Items

V1 - Variable 1 - The primary variable as selected on the primary level transmitter. This is the variable to which the primary transmitter's 4-20 mA output is programmed.
V2 - Variable 2 - The secondary variable from the primary level transmitter, that is available as a HART protocol signal

LRV - Lower Range Value (4 mA)
V1C - Variable 1 Current
V2C - Variable 2 Current
TMP - Temperature
SET - Setup Menu
CAL - Calibration Menu
CFG - Configuration Menu
URV - Upper Range Value (20 mA)
DAC TRIM - Digital Analog Converter Trim
D 4 - DAC Trim 4 mA Output
D20 - DAC Trim 20 mA Output
NUM - Number of Variables
PV= - Process Variable for Output

G. Warnings

- Do not attempt to communicate with the RI100 or the Primary Transmitter using a handheld communicator when they are under normal operation. Attempting to do so may cause cross talk between the transmitters and the communicator resulting in setup changes or operation interruptions. If communication to the RI100 or Primary Transmitter is required, remove the wiring connection from the Primary Transmitter to the Isolation Board of the RI100.
- "Dirty" power can cause communication failures between the RI100 and the Primary Transmitter. Power supplied to the RI100 and the Primary Transmitter should be free of AC ripples. Power conditioning devices may be required where power is not clean.
- Loop wiring of the RI100 should be completely isolated from the loop wiring of the Primary Transmitter. Some installations may require a 1:1 loop isolator for the RI100 loop to function properly.

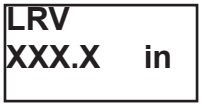
4.0 SETUP AND OPERATION

H. CAL - Calibration Menu

On power-up, the RI100 Repeater Indicator uses HART communication to automatically detect the Primary Transmitter which it is connected to. After identifying the transmitter, the RI100 retrieves setup information from the primary transmitter including the calibration range for all available variables. The output range of the RI100 output can be adjusted by recalibrating the Lower an Upper Range Values. The LRV and URV will only affect the settings for the Process Variables selected in the Configuration Menu.

1. LRV - Lower Range Value

LRV is a value in engineering UNITS which determines at which measured value the RI100 will generate an output of 4.00 mA. Traditionally this is known as the zero point. Upon power up, the RI100 will receive this information from the Primary Transmitter.



To change the LRV:

1. Press the SELECT button.
2. Scroll UP or DOWN to select each digit.
3. Press the SELECT button to set the digit and move to the next digit in sequence.
4. After the last digit is set, press the SELECT button to set the new LRV.
5. Scroll UP to END MENU.
6. Pressing the SELECT button now will return you to the main display.

2. URV - Upper Range Value

URV is a value in engineering UNITS which determines at which measured value the RI100 will generate an output of 20.00mA. Traditionally this is known as the span point. Upon power up, the RI100 will receive this information from the Primary Transmitter.

To enter the URV:

1. Press the SELECT button.
2. Scroll UP or DOWN to select each digit.
3. Press the SELECT button to set the digit and move to the next digit in sequence.
4. After the last digit is set, press the SELECT button to set the new URV.
5. Scroll UP to END MENU.
6. Pressing the SELECT button now will return you to the main display.

Note:

1. If “M5” module is in Primary Transmitter, “Temp” will also be displayed in “CFG” Menu under “PV =”.
2. Degrees “F” or “C” can be selected under CFG in M5 module if Temp is selected.

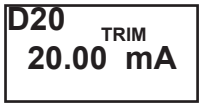
4.0 SETUP AND OPERATION

3. DAC TRIM

The RI100 is a 2 wire loop powered device. It will generate a milliamp output over a range of 3.61 to 21.00 mA. When an RI100 is calibrated at the factory, the output of the unit will be set to correspond to a calibrated multi-meter. The exact output for 4 and 20 milliamps is set using the DAC TRIM function. When an RI100 is installed and wired, the field wiring and other loop components may affect the milliamp output that is received at the point of control. The DAC TRIM will be used to compensate for the loop components and allow the point of control to receive a true 4 to 20 milliamps.

To adjust either the 4 or 20 mA DAC TRIM:

1. A means of measuring the current output must be established in the control loop.
2. To enter the DAC TRIM sub menu press the “SELECT” and either “UP” or “DOWN” at the same time.
3. Scroll to the desired function, D4 or D20.
4. Press SELECT at the desired function and use the SELECT, UP and DOWN buttons enter the current value displayed on the current meter. Press the SELECT button to set each digit and move to the next digit in sequence.
5. After the last digit is set, the mA output will adjust to exactly 4 or 20 mA. If is does not, repeat step 4.
6. Repeat steps 3 through 5 for the opposite DAC TRIM function.
7. Scroll to END.
8. Pressing the SELECT button now will return you to the main screen.

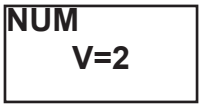


4.0 SETUP AND OPERATION

I. CFG - Configuration Menu

On power-up, the RI100 Repeater Indicator uses HART communication to automatically detect the Primary Transmitter which it is connected to. After identifying the transmitter, the RI100 retrieves setup information from the primary transmitter including the number of variables. The RI100 will automatically select the second variable from the Primary Transmitter for its milliamp output. If desired, the PV or Process Variable for the milliamp output of the RI100 may be changed.

1. NUM - Number of Variables



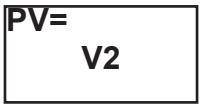
The Primary Transmitter will be capable of measuring 1, 2, or 3 variables including level, interface and temperature. The number of variables present in the primary transmitter will be reflected in the RI100 upon power up of the Repeat Indicator.

To change the Number of Variables:

1. Press the SELECT button.
2. Scroll the UP and DOWN to change the Number of Variables.
3. Press the SELECT button to set the new NUM.
4. Scroll UP to END.

Pressing the SELECT button now will return you to the main display.

2. PV= - Process Variable



Process Variable determines which measured value the RI100 will base its milliamp output on. When the RI100 is powered, it will automatically select the secondary variable (VS or TEMP) depending on module. Primary must be M5 (A, B or S) modules for temperature.

To change the Process Variable:

1. Press the SELECT button.
2. Scroll UP or DOWN to select the output variable.
3. Press the SELECT button to set the PV.
4. Scroll DOWN to END.
5. Pressing the SELECT button now will return you to the main display

In a typical installation using an AT100 equipped with two floats or an AT200 (mounted to a Magnetic Level Gauge with the transmitter housing at the top of the chamber) as the Primary Transmitter:

1. Set PV= on the AT100 to LL1 (to output a 4-20mA signal based on the total level.)
2. Set PV= on the RI100 to V2 (to output a 4-20mA signal based on the interface level.)

In a typical installation using an AT200 (mounted to a Magnetic Level Gauge) with the transmitter housing at the bottom of the sensor as the Primary Transmitter:

1. Set PV= on the AT100 to LL2 (to output a 4-20mA signal based on the total level.)
2. Set PV= on the RI100 to V2 (to output a 4-20mA signal based on the interface level.)

Note: As shown above, the primary level default (LL1) is set to the variable closest to the sensor (transmitter).

1. Top mounted transmitter - LL1 = total level
2. Bottom mounted transmitter - LL1 = interface level

5.0 TROUBLESHOOTING

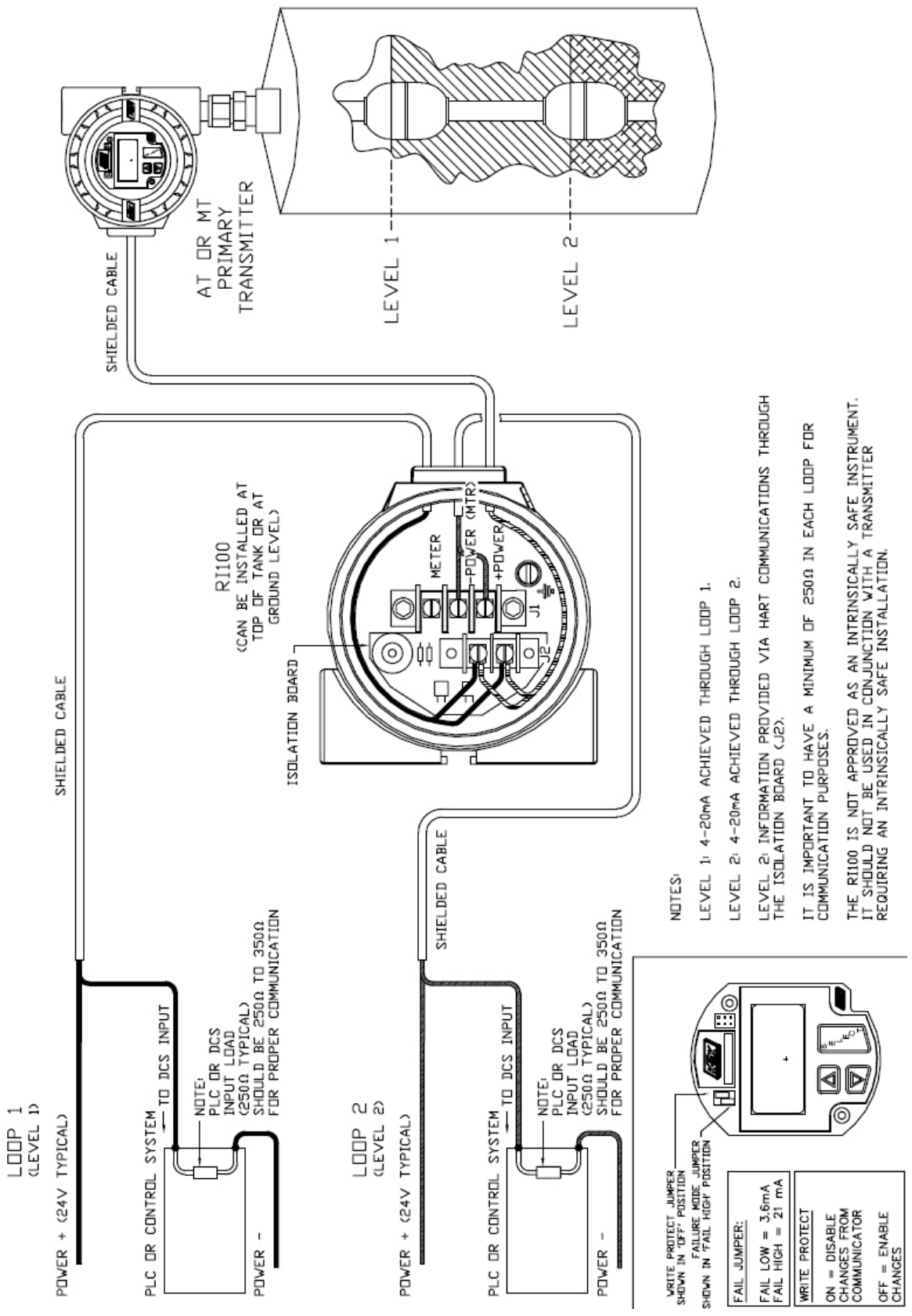
A. Valid Current Loop Outputs

20.97 mA	If the top board jumper is set to HI ALARM a loss of measurement by the Primary Transmitter, a lack of communication between the Primary Transmitter and the RI100 or a malfunction will cause the output to be set to the alarm condition of 21.0 mA.
20.58 mA	When the level increases above the 20.00 mA point the output will continue up to 20.58 mA and then latch until the level returns below the 20.58 mA level.
4.00 mA to 20.00 mA	Normal output range.
3.85 mA	When the level decreases below the 4.00 mA point the output will continue down to 3.85 mA and then latch until the level returns above the 3.85 mA level.
3.61 mA	If the top board jumper is set to LO ALARM a loss of measurement by the Primary Transmitter, a lack of communication between the Primary Transmitter and the RI100 or a malfunction will cause the output to be set to the alarm condition of 3.61 mA.

B. Problems and Solutions

Symptom	Problem	Solution
Alarm Output 3.61 or 20.97 mA Asterisks on Display	Lack of communication between the Primary transmitter and the RI100	Ensure proper parallel wiring between the RI100 and Primary Transmitter
		Ensure minimum 250 ohm resistors are installed in each loop
		Ensure Loop wiring of the RI100 is completely isolated from Primary Loop wiring or install a 1:1 loop isolator in the RI100 loop
		Disconnect then reconnect Loop power of the RI100
	Malfunction in the Primary Transmitter or improper Primary Transmitter setup.	Refer to Installation and Operations Manual for the Primary transmitter for troubleshooting and setup information
	Malfunction of the RI100 electronics module	Replace the RI100 electronics module
Output of the RI100 does not match the indicated output on the RI100 or the measurement from the Primary Transmitter	Failure of the RFI filters in the Main Terminal strip of the RI100	Replace the Terminal strip
	Process Variable set to the wrong variable	Reset the PV= value according to Section F.2
Range Values or other settings keep changing	“Dirty” power	Reset any changed settings using the pushbutton display. Test power for AC ripple.
	Attempted communication using a HART handheld device.	Reset any changed setting using the pushbutton display. Do not attempt to communicate with the RI100 or Primary Transmitter using a HART handheld device while under normal operation.

6.0 TYPICAL LOOP WIRING DIAGRAM



7.0 CUSTOMER SUPPORT

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7.1 ABB RMA Form

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***** IMPORTANT CUSTOMER NOTICE: PLEASE READ PRIOR TO RETURNING PRODUCTS TO ABB*****

Be sure to include the Return Authorization (RA) number on the shipping label or package to the attention: Customer Service. A copy of this document should also be included with the packing list. ABB wants to maintain a safe work environment for its employees. In the event, the returned product or material has been in contact with a potentially hazardous chemical, per federal regulations, the customer must provide evidence of decontamination and the related chemical composition and characteristics. In order to expedite your return, please include the applicable Material Safety Data Sheets (MSDS) and decontamination tags by affixing these documents in close proximity to the shipment label for identification purposes. (January 18, 2006)

Return Authorization Form	
Customer:	Date:
Contact Name:	Product:
Contact Email:	Serial No:
Contact Phone:	Job No:
Contact Fax:	Service Rep:

Completed by Customer

Reason:

Problem Found: None

Action Requested: None

Is expedited return shipping requested? Yes

If yes, please provide a purchase order or your shipper's account number (ex FedEx or UPS).
ABB pays return transport via standard ground shipments only.

Account #:

If purchase order is issued, a copy of purchase order must be included with return authorization documentation.

Is ABB authorized to repair items determined to be non-warranty? Yes

If yes, a copy of purchase order must be included with return authorization documentation.

Customer PO#:		Date:	

Has product been in contact with any potentially hazardous chemical? Yes

If yes, documentation product and forward MSDS to ABB. "ATTN: Customer Service"

Return Repaired Product to Address

Shipping Address:	Billing Address:
	Ship Via:

8.0 WARRANTY STATEMENT

5 YEAR WARRANTY FOR:
KM26 Magnetic Liquid Level Gauges; MagWave Dual Chamber System; LS Series Mechanical Level Switches (LS500, LS550, LS600, LS700, LS800 & LS900); EC External Chambers, STW Stilling Wells and ST95 Seal Pots.

3 YEAR WARRANTY FOR:
KCAP300 & KCAP400 capacitance switches. BETA Pressure and Temperature Switches have a limited factory guarantee, excluding wetted parts & consumables.

2 YEAR WARRANTY FOR:
AT100, AT100S and AT200 series transmitters; RS80 and RS85 liquid vibrating fork switches; RLT100 and RLT200 reed switch level transmitters; TX, TS, TQ, IX and IM thermal dispersion switches; IR10 and PP10 External Relays; MT2000, MT5000, MT5100 and MT5200 radar level transmitters; RI100 Repeat Indicators; KP paddle switches; A02, A75 & A77 RF capacitance level switches and A38 RF capacitance level transmitters; Buoyancy Level Switches (MS50, MS10, MS8D & MS8F); Magnetic Level Switches (MS30, MS40, MS41, PS35 & PS45).

1 YEAR WARRANTY FOR:
KM50 gauging device; AT500 and AT600 series transmitters; LaserMeter and SureShot series laser transmitters; LPM200 digital indicator; DPM100 digital indicators; APM100 analog indicators; KVIEW series digital indicators and controllers; SF50 and SF60 vibrating fork switches, KB Electro-Mechanical Continuous Measuring Devices, KSONIK ultrasonic level switches, transmitters & transducers, ChuteMaster Microwave Transmitter / Receiver and TiltMaster Switches.

SPECIAL WARRANTY CONSIDERATIONS:
ABB does not honor OEM warranties for items not manufactured by ABB (i.e. Palm Pilots). These claims should be handled directly with the OEM.

ABB will repair or replace, at ABB's election, defective items which are returned to ABB by the original purchaser within the period specified above from the shipment date of the item and which is found, upon examination by ABB, to its satisfaction, to contain defects in materials or workmanship which arose only under normal use and service and which were not the result of either alterations, misuse, abuse, improper or inadequate adjustments, applications or servicing of the product. ABB's warranty does not include onsite repair or services. Field service rates can be supplied on request.

If a product is believed to be defective, the original purchaser shall notify ABB and request a Returned Material Authorization before returning the material to ABB, with transportation prepaid by the purchaser. (To expedite all returns/repairs from outside of the United States, consult ABB's customer service team (service@ktekcorp.com) to determine an optimal solution for shipping method and turnaround time.) The product, with repaired or replaced parts, shall be returned to the purchaser at any point in the world with transportation prepaid by ABB for best-way transportation only. ABB is not responsible for expedited shipping charges. If the product is shipped to ABB freight collect, then it will be returned to the customer freight collect.

If inspection by ABB does not disclose any defects in material or workmanship, ABB's normal charges for repair and shipment shall apply (minimum 250.00 USD).

The materials of construction for all ABB products are clearly specified and it is the responsibility of the purchaser to determine the compatibility of the materials for the application.

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