Mercury Instruments, Inc.

Setup and Operating Instructions for the 4 to 20 Milliamp Output Board, 40-2500

Purpose

The 4 to 20 board installs in a Mercury Instrument and provides two isolated 4 to 20 milliamp loop outputs which are individually settable to track selected item values.

Description

The microprocessor-based accessory board measures 2.5 by 3 inches and mounts in various ways, depending on the associated instrument. Terminals are provided for connections to a 24 volt power source and to two 4 to 20 ma loop receivers. The milliamp outputs are loop-powered. Four- and six-pin contact headers, identical to those on a Serial Cable Interface (SCI) board, are provided for cabling to an instrument.

In an ECAT, ER or Mini/Mini-AT, the 4 to 20 board connects between the external circular AMP case connector and the six-pin serial port header on the instrument's main board. The same cables are used. The 4 to 20 board can be installed in a daisy chain connection with an SCI board under two conditions: the 4 to 20 board must be connected closest to the main board, and only a Mini-type SCI board, 40-2085, can be used (even in an ECAT). Refer to the wiring diagrams provided for other instruments or configurations.

Operation

Following programming, the board polls the instrument on a periodic basis and reads the values of two selected items. For each item, it computes the percentage of its present value between presettable lower and upper limits, separate for each item. As it signs off from each serial link, it sets each loop current to the corresponding percentage in the range of 4 to 20 milliamperes.

In addition to being programmed for items to read and output scaling, the board is programmed for how often to read the items, and for how long to wait before the next attempt if the present attempt fails, such as would happen if there was a collision with a serial access from another device. The latter feature, called a holdoff delay, is designed to give other serial accesses (e. g., modem or laptop) the highest priority.

Specifications and Requirements

The operating temperature range for the board is –40F to +170F. Input power is 24 vdc +10%, -2%, less than 70 milliamperes. Loop outputs and 24 vdc input are isolated from each other and from the RS-232 circuitry to 1000 vrms. Errors: add +/- 0.3% of full scale at 70F and less than +/- 1% over temperature to the rated error of the item being reported.

Installation

For factory-installed boards, proceed to the next section. For field installation, or retrofit, follow the instructions included with the installation kit.

Field (milliamp loop) Wiring

Use shielded cable, 24 gauge or larger. It is acceptable for all field wires to the board to be within a single shield. Observe the requirement that the loop resistance, including cabling and receiver, must result in a minimum of 9 volts across the board's loop terminals (about 650 ohms total). Also observe the requirement that the voltage at the board's 24 vdc terminals under all load conditions must be 24 Volts +10% -2%.

Hardware Requirements for Programming and Testing

The 4 to 20 milliamp board may be programmed on the bench or in an instrument. It can be connected to the programming PC via serial communication cable part number 40-2645.

Test cable part number 40-2647 is used for bench testing and also provides 24 vdc power from a compact, 120 vac line-operated power supply along with convenient loop test connections for a multimeter.

For boards that are mounted in instruments, see Field Testing further below, in addition to the following.

Programming

Two programming utilities are provided for the 4 to 20 board. The first, called PR420.exe, programs the board's microprocessor according to selections made through its user interface. A selection of default setups can be selected from a drop-down menu. The second program, TEST4220.exe, simulates any Mercury instrument, allowing the board to be exercised and tested while still connected to the PC and without changing any connections.

Bench Programming and Testing Procedure using the 40-2467 Line-Powered Test Cable

Make sure no other program, including a minimized Windows application, is using the same PC COM port. The programs PR420.exe and TEST4220.exe must be together in any folder on the PC (including on a floppy or CD drive).

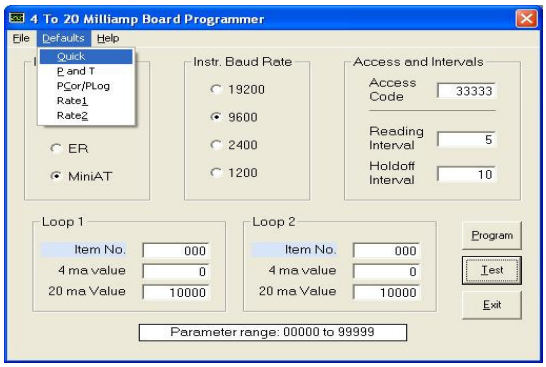
Make sure the 4 to 20 board jumper is on the "PGM" pins and the board is connected to the PC's COM port with a 40-2645 cable (connect the 6 pin plug to the header on the bottom of the board, with the shield wire toward the board's mounting holes). Tighten the board's six terminals onto the pins of the 40-2647 self-powered test cable (with power off).

Connect a digital voltmeter set to read 5 volts DC (not milliamps) to the Loop 1 test jacks, positive to red and negative to black.

Apply power to the test cable. Start the program PR420.exe. Select the proper COM port under the *File* menu.

Please note that both loops need to be programmed, whether Loop 2 is used or not. For simplicity, Loop 2 can be set the same as Loop 1 if it is not used.

If you wish to do a quick test of the board and programming setup before putting in the final program, select *Quick* under the *Defaults* menu to preload test settings for programming the board. Otherwise, make the actual selections. Next, click *Program* (also available under the *File* menu), then press *OK* to the pop-up reminder that the jumper must be on the "PGM" pins.



A progress bar should appear showing that programming is taking place.

When programming is complete, move the "PGM/RUN" jumper to the "RUN" position and press the *Test* button. Press *OK* to the reminder.

A new window will open, with DOS program TEST4220.exe running. The PR420 program has fed the setup limits to TEST4220. TEST4220 now receives link requests from the 4 to 20 board and acts like an instrument while displaying the communication going on between the 4 to 20 board and itself. While acting like an instrument it also simulates readings for each loop that change between 0, 50, and 100 percent of full scale output from one linkup to the next. This allows the operation and accuracy of the two loops to be checked by simply watching voltmeter readings. (Be sure the voltmeter is set to *volts*.)

Watch the voltmeter readings as the output of Loop 1 cycles between 0%, 50%, and 100%. Corresponding voltages will be 1.00, 3.00, and 5.00 volts, plus or minus about 0.01 volts. After verifying Loop 1, move the voltmeter to Loop 2 and verify if necessary.

When TEST4220 has cycled through all its output values and the multimeter readings have been verified, press Escape to end the program. This returns control to the PR420 program, which is ready to program again. If you did not do so during this pass, now is a good time to program the actual measurement settings into the board. This process can be repeated as many times as needed.

Disconnect power from the test cable while connecting and disconnecting the 4 to 20 boards.

Test Limits

The multimeter(s) should be set to the lowest range that will measure 5.10 volts DC. During the *Quick* test, both output loops should cycle every 15 seconds or so between 0, 50, and 100 percent of full scale output. The test cable will convert these outputs to 1.00, 3.00 and 5.00 volts DC. The allowable tolerances for these outputs are as follows:

0% output:	0.985 to 1.015 volts
50% output:	2.985 to 3.015 volts
100% output:	4.985 to 5.015 volts

Startup in the Field

When field wiring is complete and power is first applied, the loop outputs will go to their low-end value of 4 milliamps. If an instrument is connected, the loop outputs will go to their measurement values at the end of the first serial access, which will be at the end of the first programmed read interval. The outputs will be updated at the same interval from then onwards, unless other serial activity triggers a holdoff delay. Loop signals can be checked locally with a multimeter (see below).

Field Testing

Testing should be done with the 4 to 20 milliamp board finally programmed and connected to the instrument.

Field testing can be done with a multimeter set to measure 0 to 20 milliamps and connected in series with the loop, OR with the multimeter set to measure 0 to 5 volts and connected across a 250 ohm resistor which is connected in series with the loop.

Testing involves verifying that the millamp output as a percentage of the range of 4 to 20 milliamps matches the instrument reading as a percentage of the range between the lower and upper item values that were programmed into the board.

If desired, the TEST4220 program can be used to field test an installed board. TEST4220 requires only a low-end PC with either a COM1 or COM2 serial port. The 4 to 20 milliamp board, as described previously, can be connected to the PC via one of two approaches.

Approach 1: Cable number 40-2645 can be used for programming or testing when 24 vdc power and loop connections are already in place. (Disconnect the 24 volt power temporarily while making these connections.) The board is loosened from its mounting and the 40-2645 cable is connected in place of the 6-pin internal serial cable on the back of the 4 to 20 board. Connect the cable so that the shield wire is toward the board's mounting holes.

Approach 2: It may be convenient to connect to the board via the instrument's external serial port using a standard laptop cable, part no. 40-1629. Two additional steps are required for this method. A null modem, or reversing, cable such as the Mercury Modem Configuration cable (part number 40-2200) must be inserted between the PC and the laptop cable. Secondly, the internal serial cable must be temporarily unplugged from J6 on the ECAT, ER, Mini, or Mini-AT main board, or J12 on the ER main board.

For either approach, when the cable connections have been made, run TEST4220 and verify that the board is operating and requesting the proper item readings from the correct type of instrument.