

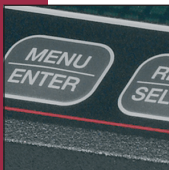
Remote Manual
Handheld Pressure Calibrator
JOFRA HPC-500

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Remote Operation

This manual describes the remote interface for the JOFRA HPC500/502. The interface uses a command, query, response protocol. Using this protocol the user can access the pressure and/or signals measured by the calibrator and control and monitor the status of all the essential functions of the calibrator.

1. Interface Description

The calibrator can be remotely controlled using a PC terminal, or by a computer program running the calibrator in an automated system. It uses an RS232 serial port connection for remote operation. With this connection the user can write programs on the PC, with Windows languages like Visual Basic to operate the calibrator, or use a Windows terminal, such as Hyper Terminal, to enter single commands. Typical RS232 remote configurations are shown in Figure 1.

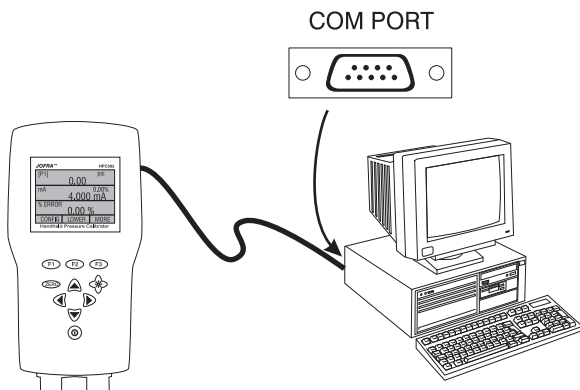


Figure 1. Calibrator-to-Computer Connection

2. Setting up the RS232 Port for Remote Control

Note: The RS232 connection cable should not exceed 15m unless the load capacitance measured at connection points is less than 2500pF.

Serial parameter values:

9600 baud

8 data bits

1 stop bit

no parity

Xon/Xoff

EOL (End of Line) character or CR (Carriage Return) or both

The LEM232 cable is used for RS232 communications from the calibrator to a computer. If the computer only has USB type ports, a USB to RS232 converter will be needed. These can be obtained from most office supply and computer stores. To connect the calibrator to the computer, attach the LEMO connector end of the cable to the pressure module port on the right side of the calibrator and the DB-9 connector to the RS232 port on the computer. The calibrator should be turned off prior to making the connection and then turned on.

To set up remote operation of the calibrator on the Windows Hyper Terminal, connected to a COM port on the PC as in Figure 1, use the following procedure:

1. Start Hyper Terminal (located in Accessories/Communications of the Windows Start menu)
2. Select New Connection.
3. For Name enter HPC500/502. Select the serial port that the calibrator is connected to.
4. Enter the above information for port settings.
5. Select ASCII setup from File/Properties/Settings and mark these choices:
 - Echo typed characters locally
 - Wrap lines that exceed terminal width
6. Select Ok
7. To see if the port works enter *IDN?. This command will return information on the calibrator.

3. Changing Between Remote and Local Operation

There are three modes of operation of the calibrator, Local, Remote, and Remote with Lockout. Local mode is the default mode. Commands may be entered using the keypad on the calibrator or using a computer. In Remote mode the keypad is disabled, and commands may only be entered using a computer, but choosing [GO TO LOCAL] from the menu on the calibrator display will restore keypad operation. In Remote with Lockout, the keypad can not be used at all. To switch modes proceed as follows:

1. To enable Remote mode, type in the serial command REMOTE at the computer terminal.
2. To enable Remote with Lockout, type in "REMOTE LOCKOUT" in either order.
3. To switch back to local operation enter LOCAL at the terminal. This command also turns off LOCKOUT if it was on. For more information on commands refer to the Remote Commands section.

4. Using Commands

4.1 Command types

Refer to the Section 5 on Remote Commands for all available commands.

The calibrator may be controlled using commands and queries. All commands may be entered using upper or lower case. The commands are divided into the following categories:

Calibrator Commands

Only the calibrator uses these commands. For example

```
VAL?
```

asks for the values displayed on the calibrator display.

Common Commands

Standard commands used by most devices. These commands always begin with an `"**"`. For example

```
*IDN?
```

tells the calibrator to return its identification.

Query Commands

Commands that ask for information, they always end with a `"?"`.

For example:

```
FUNC?
```

Returns the current modes of the calibrator displays.

Compound Commands

Commands that contain more than one command on one line. For example;

```
RTD_TYPE PT385_100;RTD_TYPE?
```

Sets the calibrator to RTD type PT385_100 and queries it to verify. It will return:

```
PT385_100
```

4.2 Character Processing

The data entered into the calibrator is processed as follows:

- ASCII characters are discarded if their decimal equivalent is less than 32 (space), except 10 (LF) and 13 (CR):
- Data is taken as 7-bit ASCII
- The most significant data bit is ignored.
- Upper or lower case is acceptable.

4.3 Response Data Types

The data returned by the calibrator can be divided into four types:

Integer

For most computers and controllers they are decimal numbers ranging from -32768 to 32768. For example:

FAULT? could return 110

Refer to the Error Codes table (Table 4) for more information on error codes.

Floating

Floating numbers have up to 15 significant figures and exponents. For example:

CPRT_COEFA? returns 3.908300E-03

Character Response Data (CRD)

Data returned as keywords. For example:

RTD_TYPE? returns PT385_100

Indefinite ASCII (IAD)

Any ASCII characters followed by a terminator. For example:

*IDN? returns AMETEK, 311/321, 250, 1.00

4.4 Calibrator Status

Error Queue

If an error occurs due to invalid input or buffer overflow, its error code is sent to the error queue. The error code can be read from the queue with the command FAULT?. The error queue holds 15 error codes. When it is empty, FAULT? returns 0. The error queue is cleared when power is reset or when the clear command *CLS is entered.

Input Buffer

Calibrator stores all received data in the input buffer. The buffer holds 250 characters. The characters are processed on a first in, first out basis.

5. Remote Commands and Error Codes

The following tables list all commands, and their descriptions, that are accepted by the calibrator.

Table 1: Common Commands

Command	Description
*CLS	(Clear status.) Clears the error queue.
*IDN?	Identification query. Returns the manufacturer, model number, and firmware revision level of the Calibrator.
*RST	Resets the calibrator to the power up state.

Table 2: Calibrator Commands

Command	Description
CPRT_COEFA	Sets the custom RTD coefficient A
CPRT_COEFA?	Returns the custom RTD coefficient A
CPRT_COEFB	Sets the custom RTD coefficient B
CPRT_COEFB?	Returns the custom RTD coefficient B
CPRT_COEFC	Sets the custom RTD coefficient C
CPRT_COEFC?	Returns the custom RTD coefficient C
CPRT_R0	Sets the custom RTD R0 resistance
CPRT_R0?	Returns the custom RTD R0 resistance
DAMP	Turns Damp on or off.
DAMP?	Returns if DAMP is on/off
DISPLAY	Turns on/off the displays specified in the command
DISPLAY?	Returns which displays are on/off
FAULT?	Returns the most recent error code
ERROR_LOOP	Turns loop power on or off in percent error mode
ERROR_LOOP?	Returns the current state of loop power in error mode
ERROR_MODE	Turns percent error mode on or off
ERROR_MODE?	Returns whether percent error mode is on or off
ERROR_PORT	Set the pressure port for percent error mode
ERROR_PORT?	Returns the pressure port for percent error mode
FUNC	Sets the display mode as specified in the command
FUNC?	Returns the current mode of the upper, middle, and lower display
HI_ERR	Sets the 100% of span limit for percent error mode

HI_ERR?	Returns the 100% of span limit for percent error mode
LEAKTEST_OFF	Returns calibrator from leak test mode
LOCAL	Returns user to manual operation of the calibrator
LOCKOUT	Locks out the keypad of the calibrator in remote operation
LO_ERR	Sets the 0% of span limit for percent error mode
LO_ERR	Returns the 0% of span limit for percent error mode
OHMS?	Returns ohms value measured from the RTD
PRES_UNIT	Set the pressure unit for the indicated display
PRES_UNIT?	Returns the pressure from the indicated display
REMOTE	Puts the calibrator in remote mode
RTD_TYPE	Sets the RTD type
RTD_TYPE?	Returns the RTD type
ST_START	Starts a switch test
ST_OPEN?	Returns pressure value at which the switch opened
ST_CLOSE?	Returns pressure value at which the switch closed
ST_DEAD?	Returns pressure value of the deadband of the switch
TEMP_UNIT	Set the RTD to read in °F or °C on the indicated display
TEMP_UNIT?	Returns the unit the RTD is set to read on the indicated display
VAL?	Returns the measured values
ZERO_MEAS	Zeros the pressure module
ZERO_MEAS?	Returns the zero offset of the pressure module

Table 3: Parameter units

Units	Meaning
MA	milliamps of current
V	Voltage in volts
CEL	Temperature in Celsius
FAR	Temperature in Fahrenheit
OHM	Resistance in Ohms
PSI	Pressure in pounds per square-inch
INH2O4C	Pressure in inches of water at 4°C
INH2O20C	Pressure in inches of water at 20°C
INH2O60F	Pressure in inches of water at 60°F
CMH2O4C	Pressure in centimeters of water at 4°C
CMH2O20C	Pressure in centimeters of water at 20°C

BAR	Pressure in bars
MBAR	Pressure in millibars
MPAL	Pressure in MegaPascals
KPAL	Pressure in kiloPascals
INHG	Pressure in inches of mercury at 0°C
MMHG	Pressure in millimeters of mercury at 0°C
KG/CM2	Pressure in kilograms per square-centimeter
MMH2O4C	Pressure in millimeters of water at 4°C
MMH2O20C	Pressure in millimeters of water at 20°C
ON	Turn something on
OFF	Turn something off
UPPER	Upper Display
MIDDLE	Middle Display
Lower	Lower Display
DCI	Current measure function
DCI_LOOP	Current measure function with loop power
DCV	Voltage measure function
RTD	Temperature measure function
P1	Port P1 pressure measure function
P2	Port P2 pressure measure function
P1_ST	Switch Test with port P1 pressure measure function
P2_ST	Switch Test with port P2 pressure measure function

Table 4: Error Codes

Error Number	Error Description
100	A non-numeric entry was received where it should be a numeric entry
101	Too many digits entered
102	Invalid units or parameter value received
103	Entry is above the upper limit of the allowable range
104	Entry is below the lower limit of the allowable range
105	A required command parameter was missing
106	An invalid command parameter was received
107	Pressure not selected
108	Invalid sensor type
109	Pressure module not connected

110	An unknown command was received
111	Bad Parameter received
112	The serial input buffer overflowed
113	Too many entries in the command line
114	The serial output buffer overflowed

6. Entering Commands

Commands for the calibrator may be entered in upper or lower case. There is at least one space required between the command and parameter, all other spaces are optional. Almost all commands for the calibrator are sequential; any overlapped commands will be indicated as such. This section will briefly explain each of the commands and describe their general use, which will include any parameters that may be entered with the command as well as what the output of the command is.

6.1 Common Commands

*CLS

Clears the error queue. Also terminates all pending operations. When writing programs, use before each procedure to avoid buffer overflow.

*IDN?

Returns the manufacturer, model number, and firmware revision of the Calibrator. For example:

*IDN? will return AMETEK, 311/321, 0, 1.00

6.2 Calibrator Commands

CPRT_COEFA

This command is used for entering a custom RTD into the calibrator. The numeric value entered after the command will be set as the first coefficient of the polynomial used by the custom RTD.

For example:

CPRT_COEFA 3.908300E-03 enters 3.908300e-3 as coefficient A.

CPRT_COEFA?

Returns the number that was entered for the first coefficient of the polynomial used in the custom RTD. Using the example above CPRT_COEFA? Would return:

3.908300E-03

CPRT_COEFB

This command is used for entering a custom RTD into the calibrator. The numeric value entered after the command will be set as the second coefficient of the polynomial used by the custom RTD.

For example:

CPRT_COEFB -5.774999E-07 enters -5.774999E-07 as coefficient B.

CPRT_COEFB?

Returns the number, which was entered for the second coefficient of the polynomial used in the custom RTD. Using the example above, CPRT_COEFB? Would return:

-5.774999E-07

CPRT_COEFC

This command is used for entering a custom RTD into the calibrator. The numeric value entered after the command will be set as the first coefficient of the polynomial used by the custom RTD.

For example:

CPRT_COEFC -4.183000E-12 enters -4.183000E-12 as coefficient C.

CPRT_COEFC?

Returns the number that was entered for the third coefficient of the polynomial used in the custom RTD. Using the example above CPRT_COEFC? Would return:

-4.183000E-12

CPRT_R0

Sets the 0° resistance, R0, in the custom RTD. The value must be entered with a units label. Refer to the Parameter Units table for assistance.

For example:

CPRT_R0 100 OHM sets R0 to 100 ohms.

CPRT_R0?

Returns the value for the resistance in custom RTD. The above example would return:

1.000000E+02, OHM

DAMP

Turns the dampening function on or off.

For example:

If you send DAMP ON this will turn the dampening function on.

DAMP?

Returns the current state of the dampening function.

For example:

If you send DAMP? It will return ON if the dampening function is on.

DISPLAY

Turns the indicated display on or off.

For example:

If you send DISPLAY LOWER, ON this will turn the lower display on.

DISPLAY?

Returns the current state of the each of the displays.

For example:

If you send DISPLAY? It will return ON, ON, ON if the all the displays are on.

FAULT?

Returns the error code number of an error that has occurred. The command may be entered when the previous command did not do what it was meant to do.

For example, if a value for current output is entered that is bigger than the supported range (0-24mA) FAULT? Would return:

103 which is the code number for an entry over range.

Refer to the Error Codes table for more information on error code numbers.

ERROR_LOOP

Turns loop power on or off in percent error mode.

For example:

To set loop power on send ERROR_LOOP ON.

ERROR_LOOP?

Returns the current state of loop power in percent error mode.

For example:

If you send ERROR_LOOP? It will return ON if loop power is on in error mode.

ERROR_MODE

Turns percent error mode on and off.

For example:

To turn on percent error mode send ERROR_MODE ON.

ERROR_MODE?

Returns the current state of percent error mode.

For example:

If you send ERROR_MODE? It will return ON if the calibrator is in percent error mode.

ERROR_PORT

Sets the pressure port for percent error.

For example:

To set the pressure port for percent error to [P1] send ERROR_PORT P1.

ERROR_PORT?

Returns the current pressure port for percent error mode.

For example:

If you send ERROR_PORT?, it will return P1 if the pressure port in percent error is [P1].

FUNC

Sets the display indicated in argument one to the function indicated in argument 2.

For example:

To set the lower display to RTD mode send FUNC LOWER,RTD.

FUNC?

Returns the current mode of all displays. For example if the calibrator is set to [P2] ST on the upper display, [P1] on the middle, and RTD on the lower, FUNC? Would return:

ST_P2,P1,RTD

HI_ERR

Sets the 100% point for the percent error mode calculation in the current engineering units.

For example:

To set the 100% point to 100 psi send HI_ERR 100.

HI_ERR?

Returns the 100% point for the percent error mode calculation.

For example:

If the 100% point is set to 100 psi, HI_ERR? would return 1.000000E+02, PSI .

LEAKTEST_OFF

If the Calibrator was in leaktest mode it returns it to normal operation.

LOCAL

Restores the calibrator to local operation if it was in remote mode. Also clears LOCKOUT if the calibrator was in lockout mode.

LOCKOUT

Sending this command sets the lockout state, when the unit is in REMOTE or goes to remote it prohibits use of the keypad completely. The lockout state can only be cleared by sending the LOCAL command.

LO_ERR

Sets the 0% point for the percent error mode calculation in the current engineering units.

For example:

To set the 0% point to 20 psi send LO_ERR 20.

LO_ERR?

Returns the 0% point for the percent error mode calculation.

For example:

If the 0% point is set to 20 psi, LO_ERR? would return 2.000000E+01, PSI .

OHMS?

Returns the raw Ohm value from the RTD.

For example:

If when measuring a P100-385 at 0 degrees cel sending OHMS? would return 1.000000E+02, OHM .

PRES_UNIT

Used to set the pressure unit for the indicated display

For example:

To set the pressure unit to psi on the lower display send PRES_UNIT LOWER, PSI.

PRES_UNIT?

Returns the pressure unit used when measuring pressure for each of the 3 displays.

REMOTE

Puts the calibrator in remote mode. From the remote mode the user can still use the keypad to get back to local unless the command LOCKOUT was entered before REMOTE. Then the keypad is totally locked out, and the user has to send the LOCAL command to get back to local operation.

RTD_TYPE

Sets the RTD type. The following is a list of RTD types the way they should be entered after the command:

PT385_100; PT392_100; PTJIS_100; CUSTOM;

For Example:

RTD_TYPE PT385_100 sets RTD type to PT100-385

RTD_TYPE?

Returns the RTD type.

For Example:

If the RTD type is PT385_100, RTD_TYPE? Will return PT100_385.

ST_START

Starts a switch test.

ST_CLOSE?

Returns the pressure that the switch closed at in the current pressure units.

ST_OPEN?

Returns the pressure that the switch opened at in the current pressure units.

ST_DEAD?

Returns deadband of the switch in the current pressure units.

TEMP_UNIT

This command is used to the temperature unit used when measuring temperature.

The first argument indicates which display to apply the change to. The second argument is the unit, either CEL for Celsius or FAR for fahrenheit.

For example:

To set the temperature unit to fahrenheit on the lower display send
TEMP_UNIT LOWER, FAR.

TEMP_UNIT?

Returns the temperature unit, (CEL or FAR) used when measuring RTDs for each of the 3 displays.

VAL?

Returns the value of any measurement taking place on the upper and lower display. For example, if the upper display is measuring 5mA, and the lower display is measuring 10V, then VAL? will return:

5.000000E-03, A, 1.000000E+01, V

ZERO_MEAS

Zeroes the attached pressure module. Enter the zeroing value in PSI after the command when zeroing an absolute pressure module.

ZERO_MEAS?

Returns the zero offset or the reference value for absolute pressure modules.



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