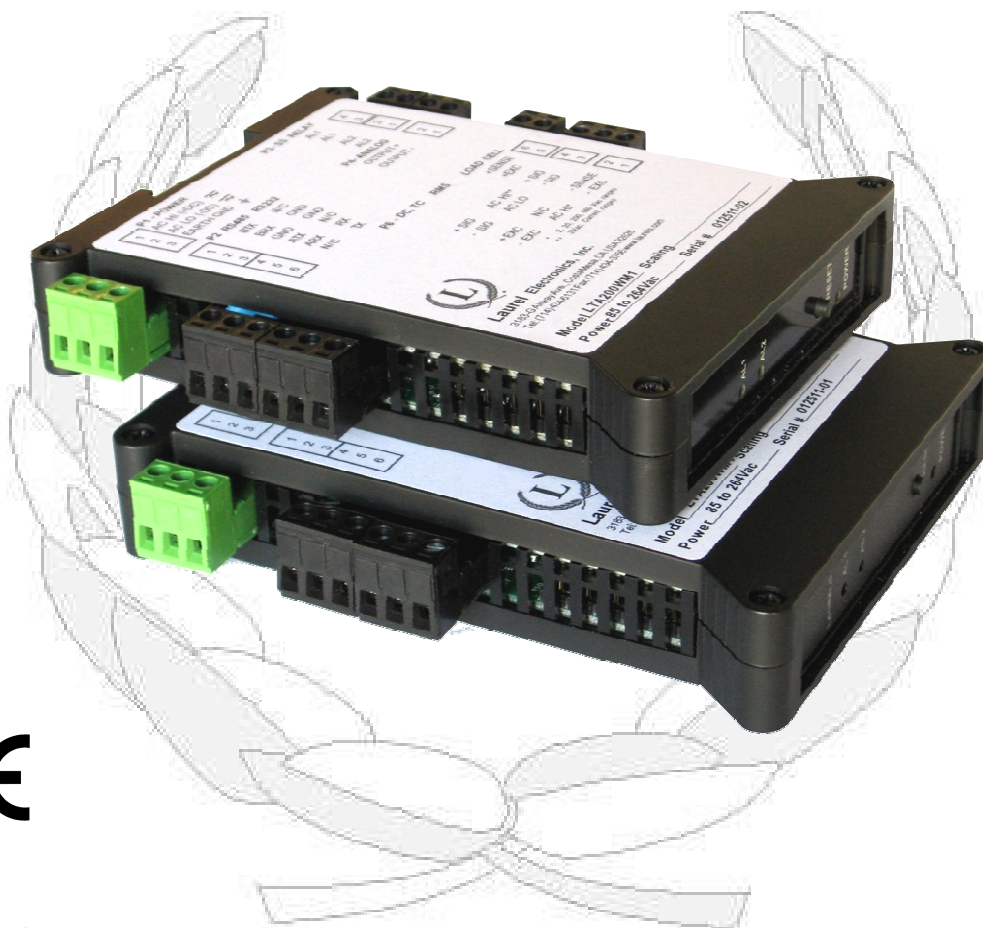


Model LTS6

RS232 OR RS485 SERIAL INPUT, ANALOG OUTPUT TRANSMITTER

Modbus or Custom ASCII Protocol

OWNERS MANUAL



CE



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1. ORDERING GUIDE, SERIAL INPUT TRANSMITTER

Configure a model number in this format: **LTS60, CBL04**

☐ **LTS6**...Transmitter with 4-20 mA, 0-20 mA, 0-10V or -10V to +10V isolated analog output, RS232 or RS485 serial data input, and dual 120 mA solid state relays. Default jumpered for RS232.

☐ **LTSE6E**... Transmitter with 4-20 mA, 0-20 mA, 0-10V or -10V to +10V isolated analog output, Ethernet serial data input, and dual 120 mA solid state relays.

☐ **Power**
0.....85-264 Vac or 90-300 Vdc
1.....12-30 Vac or 10-48 Vdc

ACCESSORIES

CBL04.....RS232 cable, two 3-pin connectors on transmitter end, DB9 connector on computer end.

CBL02.....USB to DB9 adapter cable. Can be used with CBL01 or CBL04.

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3. INTRODUCTION, RS232 OR RS485 SERIAL INPUT TRANSMITTER

The LTS6 serial input to analog output transmitter (or serial-to-analog converter) accepts RS232 or RS485 serial data using the Modbus or Custom ASCII protocol, and converts it to an isolated, scalable 4-20 mA, 0-20 mA, 0-10V or -10V to +10V analog output. The unit fits on a 35 mm DIN rail and is only 22.5 mm (0.89") thick. It is normally powered by AC (85-264 Vac), but can optionally be powered by low voltage AC or DC. All electrical connections are via detachable screw-clamp plugs. A separate manual covers the **LTSE6** serial input to analog output transmitter, which accepts Ethernet data and converts to an isolated, scalable 4-20 mA, 0-20 mA, 0-10V or -10V to +10V analog output.

The current or voltage transmitter output is jumper selectable and is transformer isolated to avoid ground loops. Either output provides 16-bit resolution of the output span and is ultra-linear to within one bit. The output is scaled to the serial input in software. Output accuracy is $\pm 0.02\%$ of span.

Dual solid state relays rated 120 mA at 140 Vac or 180 Vdc are standard. The relays can respond to the transmitted serial values or to transmitted control characters, which override the internal setpoints. The relays can also be controlled independently of the serial input by applying signals to control inputs 1 and 2.

Isolation to 250V rms is provided for power, the serial data input, analog output, and relay outputs. Isolation adds safety and avoids possible ground loops.

Default serial settings are for RS232 and full-duplex RS485. Half-duplex RS485 can be selected via jumpers or external wiring.

Transmitter setup is via the unit's serial port using an external PC and Instrument Setup software. This software can be downloaded from our website at no charge. The required 3-wire transmitter-to-PC interface RS232 cable is easy to build and is also available for purchase.

4. RECEIVING & UNPACKING YOUR TRANSMITTER

Your transmitter was carefully tested and inspected prior to shipment. Should the transmitter be damaged in shipment, notify the freight carrier immediately. In the event the transmitter is not configured as ordered or is inoperable, return it to the place of purchase for repair or replacement. Please include a detailed description of the problem.

5. SAFETY CONSIDERATIONS



Warning: Use of this transmitter in a manner other than specified may impair the protection of the device and subject the user to a hazard. Visually inspect the unit for signs of damage. If the unit is damaged, do not attempt to operate.

Caution:

- This unit may be powered with AC (mains) from 85-264 Vac or 90-300 Vdc with the high voltage power supply option, or 12-30 Vac or 10-48 Vdc with the low voltage power supply option. Verify that the proper power option is installed for the power to be used. This transmitter has no AC (mains) switch. It will be in operation as soon as power is applied.
- The 85-264 Vac or 90-300 Vdc mains connector (P1 Pins 1-3) is colored **green** to differentiate it from other input and output connectors. The 12-30 Vac or 10-48 Vdc mains connector is colored **black**.
- To avoid dangers of electrocution and/or short circuit, do not attempt to open the case while the unit is under power. However, signal wiring changes external to the case can be made safely while the unit is under power.
- To prevent electrical or fire hazard, do not expose the transmitter to excessive moisture.
- Do not operate the transmitter in the presence of flammable gases or fumes. Such an environment constitutes an explosion hazard.
- Secure the transmitter to a 35 mm DIN rail.

Symbols used:



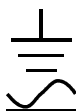
Caution (refer to accompanying documents)



Caution, risk of electric shock.



Equipment protected throughout by double insulation or reinforced insulation.



Earth (ground) terminal.

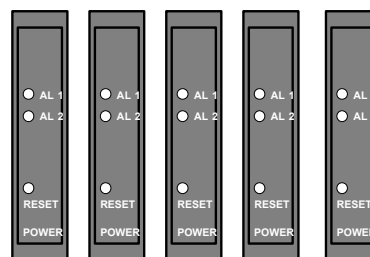


Both direct and alternating current.

Operating environment:

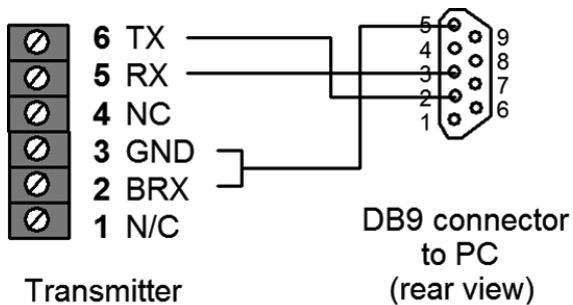
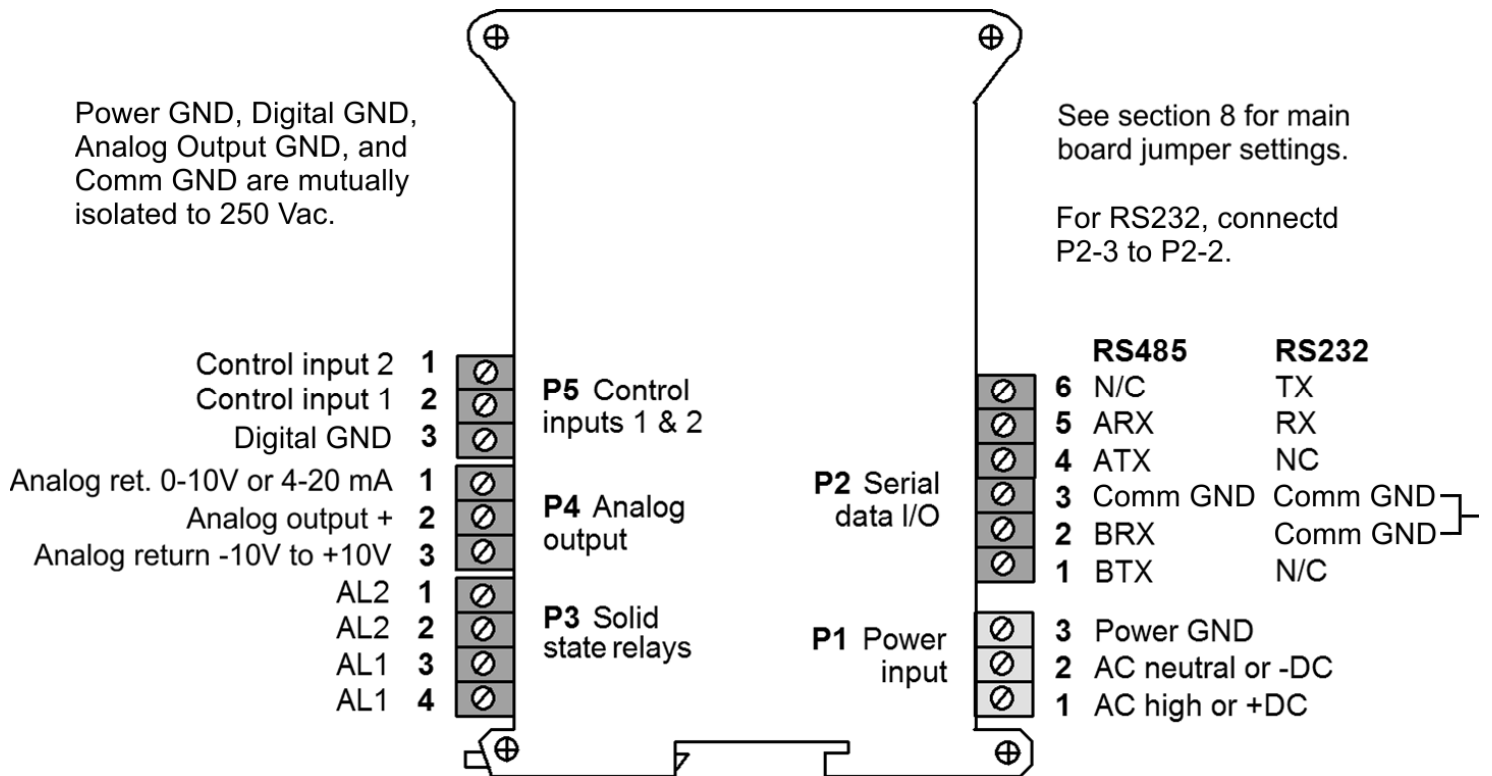
- Class II (double insulated) equipment designed for use in Pollution degree 2.

PROVISION FOR COOLING

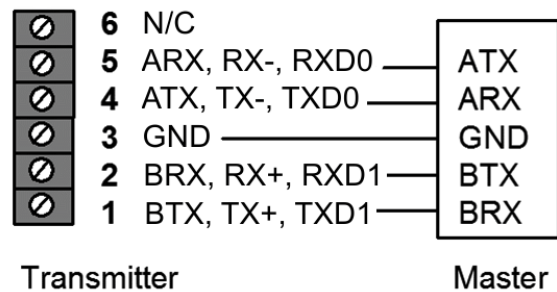


To avoid overheating, mount transmitters with ventilation holes at top and bottom. Leave a minimum of 6 mm (1/4") between transmitters, or force air with a fan.

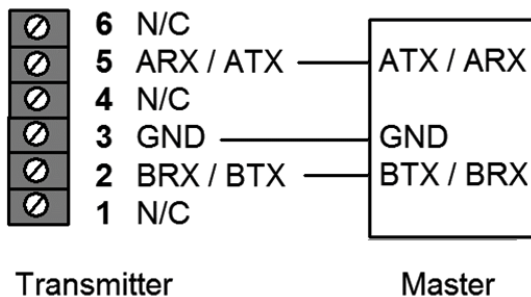
6. TRANSMITTER FIELD WIRING



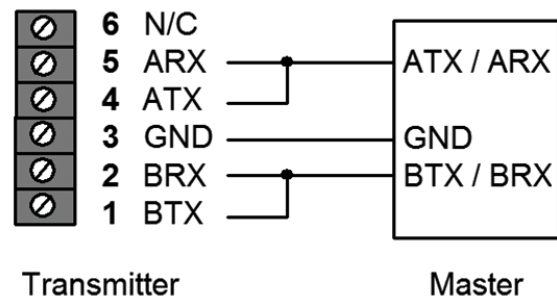
RS232 wiring



RS485 wiring, full duplex

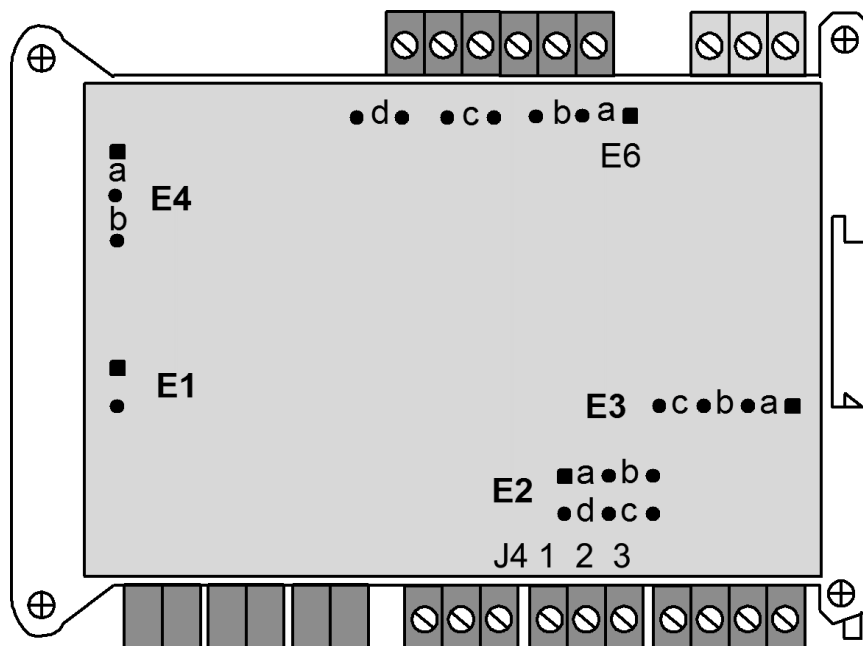


**RS485 wiring, half duplex
with internal jumpers.**



**RS485 wiring, half duplex
with external jumpers.**

7. JUMPER SETTINGS



Serial Signal	Duplex	Jumpers	Termination Resistor*
RS485	Full	None	E6 a = Transmit E6 c = Receive
	Half	E6 b + d**	E6 c
RS232	Full	None	None

* The termination resistor jumper settings should only be selected if the transmitter is the last device on an RS485 line longer than 200 feet (60 m).

** Or connect external BTX to BRX and ATX to ARX (same effect as internal jumpers).

To reset communications to 9600 baud, command mode, Custom ASCII protocol, and Address 1, place a jumper at E1, cycle power, remove the jumper, and restart the transmitter.

Analog Output	J4 Pins	Jumpers	Excitation Output	Jumpers
Current, 4-20 mA	1 Lo, 2 Hi	E2 a + d	5V, 100 mA	E3 a + c; E4 a
Voltage, 0-10V	1 Lo, 2 Hi	E2 b + c	10V, 120 mA	E3 a + c; E4 b
Voltage, -10V to +10V	3 Lo, 2 Hi	E2 b + c	24V, 50 mA	E3 b, E4 none

Notes: 1. Jumper settings are for counter main board Rev J.

2. Attempting to draw more than rated excitation output current will shut down the output.

3. The analog output is sourcing. Do not apply an external voltage. Applying an external voltage of 24 Vdc will burn out the transmitter main board.



WHEN TO CHANGE JUMPERS

Your transmitter case does not need to be opened if jumpers have already been set by your distributor. Otherwise you will need to open the case and either set jumpers or verify that the factory default jumper positions will meet your needs. Factory default jumper settings are for RS232 input and 4-20 mA output.

HOW TO OPEN & CLOSE THE CASE



The two clamshell halves of the case are held together with a bolt and a nut at each of the four corners. Use a Phillips screwdriver to remove the four bolts. The nut will then drop off, and the clamshell halves will separate. When closing the case, make sure that the ventilation grills are properly aligned.



Caution: The nuts at each corner are not captive and are black. Take precautions so that the nuts do not get lost.

8. PROGRAMMING YOUR TRANSMITTER

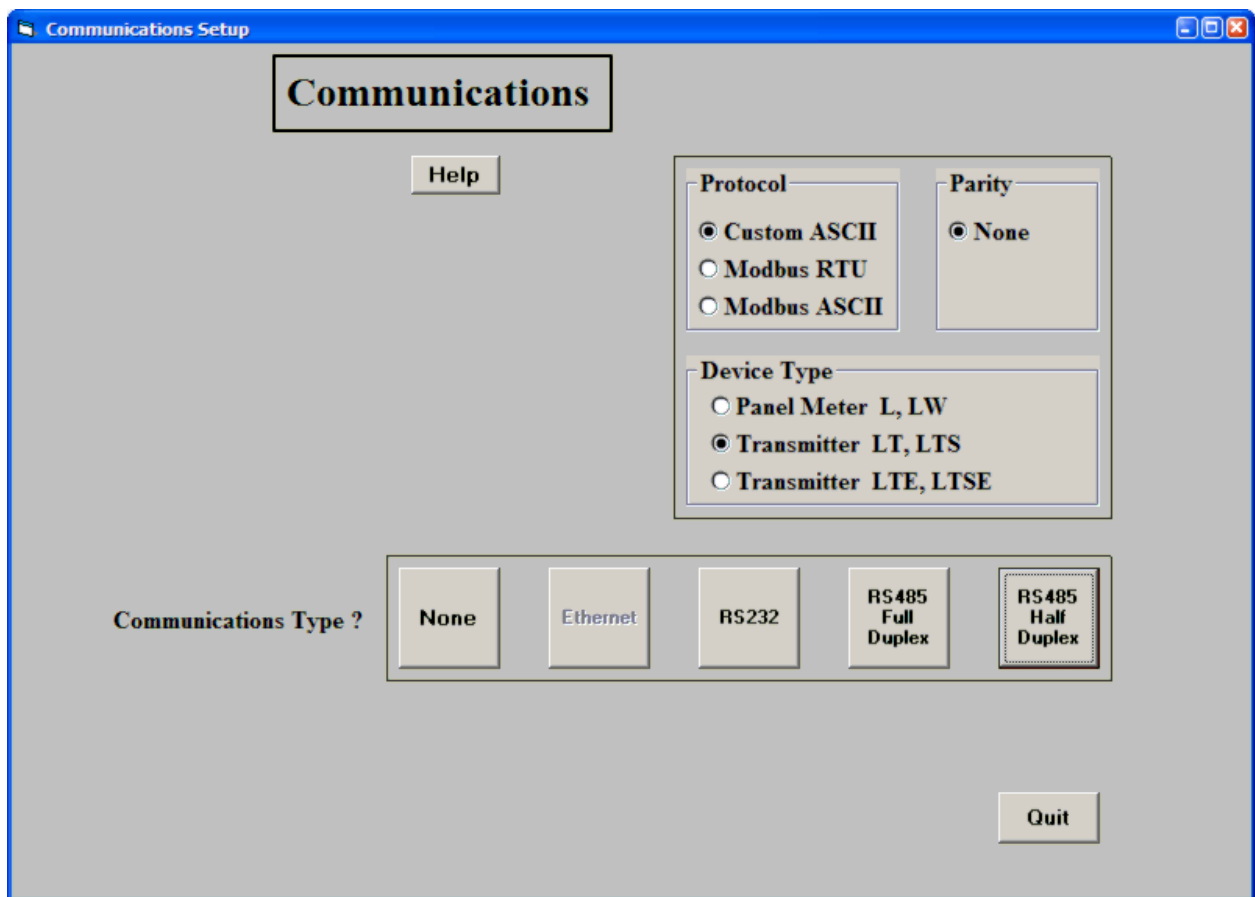
OVERVIEW

Serial input transmitters are programmed using a PC with an RS232 port and Instrument Setup (IS) software, which provides a graphical user interface. The software allows uploading, editing, downloading and saving of setup data.

CONNECTING TO YOUR PC

Use a 3-wire RS232 cable (P/N CBL04) to connect your transmitter to the COM port of your PC. Download the file ISx_x_x.exe from our website and double-click on the file name. Click on “Install Instrument Setup Software” and follow the prompts. To launch IS software, press on Start => Programs => IS2 => Instrument Setup or on the desktop icon that you may have created. Following a brief splash screen, the Communications Setup screen will appear.

ESTABLISHING COMMUNICATIONS



In the Communications Setup screen, select Custom ASCII as the Protocol, as this is the factory default setting. Select Transmitter LT as the Device Type. Then click on the RS-232 (USB) button. In the resulting Establish Communications screen, select your Com Port and

9600 as the Baud Rate. You will be able to change your protocol and baud rate later under the Communication setup tab. Click on Establish, and the two fields at the bottom of the screen should turn green and display your communication parameters and the counter-transmitter revision level. Click on Main Menu. The computer will remember your communication settings for the next time that you run IS software.

Establish Communications

Com Ports

- ☒ Com 1
- ☐ Com 2
- ☐ Com 3
- ☐ Com 4
- ☐ Com 5
- ☐ Com 6
- ☐ Com 7
- ☐ Com 8
- ☐ Com 9

Other Com Port

Baud Rate

- ☐ 300
- ☐ 600
- ☐ 1200
- ☐ 2400
- ☐ 4800
- ☒ 9600
- ☐ 19200
- ☐ 38400 Future Use

Establish

Main Menu

Back

Quit

Communication Established on Com 1, Baud = 9600, Custom ASCII Address = 1, Parity = None

Meter Type Counter Transmitter Revision 81

The best way to learn IS software is to experiment with it. From the Main Menu, click on Counter => Get Setup to retrieve (or get) the existing setup data from your counter-transmitter. Click on View => Setup to bring up screens which allow you to easily edit the setup file using pull-down menus and other selection tools. You can download (or put) your edited file into the transmitter by clicking on Counter => Put Setup. You can save your setup file to disk by clicking on File => Save Setup and retrieve a previously saved file from disk by click on File => Open.

After selecting a screen input field, pressing the F1 key will bring up detailed help information for that field.

SETTING UP BASIC OPERATION

The screenshot shows the 'Input+Display' configuration window. It has several tabs: 'Input+Display' (selected), 'Scaling', 'Filter', 'Relay Alarms', 'Communication', and 'Analog Out'. Under 'Input+Display', there are radio buttons for 'BASIC' (selected) and 'EXTENDED'. To the right, there are 'Option' and 'Input Option' labels, with a dropdown menu currently set to 'None'. Below this is the 'Signal Input' section with 'Mode' (None), 'Function' (None), 'Gate Time' (000.30 Secs), and 'Time Out' (000.00 Secs). The 'Display' section includes 'Type' (Remote A), 'Filter' (Unfiltered), and 'Power-On Total' (Zero Total). A red rectangular display area is present, followed by a 'Read' button. The 'Control Inputs' section features a pull-down menu with options: 'Control Input 1', 'Control Input 2', and 'Both Ctrl 1, 2'. The selected option is 'Meter Reset'. The 'Calibration' section shows 'Parts per Million' set to '-00048.'.

Under the Input+Display tab, select 000.00 Secs for Time Out. Ignore Signal Input, Gate Time, Filter, and Power-On Total, as these parameters do not apply to the serial input transmitter.

Under Display, select the Remote A, Remote S or Remote C operating modes, which are explained under the “Custom ASCII Protocol Transmitter Communications” section of this manual.

The Control Inputs pull-down menu controls the effect of grounding Control Input 1, Control Input 2, or both. Selections applicable to the serial input transmitter are the following:

- Meter Reset, Function Reset, Meter Reset (first row). When this row is selected, grounding Control Input 2 (causes a function reset, which resets latched alarms).
- Activate Alarm 1, Activate Alarm 2, Activate Alarm 1&2. When this row is selected, grounding Control Input 1 activates relay 1, grounding Control Input 2 activates relay 2, and grounding both inputs activates Alarms 1 & 2.
- Tare Enable, Tare if Enabled, Tare (last row). When this row is selected, grounding Control Input 1 (normally with a permanent connection) enables the Tare function. Momentarily grounding Control Input 2 stores the current digital value as an offset and subtracts this offset from the digital reading sent to the transmitter, resulting in a zero value for alarms and the analog output. This offset will also be subtracted from all new readings sent to the transmitter. To change the offset, momentarily ground Control Input 2 for the new input.

SETTING UP COMMUNICATIONS (REMOTE A & S MODES)

The screenshot shows a software interface with the 'Communication' tab selected. The 'Serial Communications' section is active, displaying the following settings:

- Baud Rate:** 9600
- Address:** 1
- Output Items:** Item 1
- Output Filter:** Unfiltered
- Output Rate:** Read Rate
- Output Mode:** Command
- Incl Alarm Data:** ☐
- Include LF:** ☐
- CR (LF):** At End of All
- Full/Half Duplex:** Full Duplex
- Serial Protocol:** Custom ASCII
- Recognition Char:** Standard *

The above screen will appear under the Communication tab if Remote A or Remote S has been selected as Display Type under the Input+Display tab. These two modes are not able to extract data from an ASCII string that contains multiple data values and non-numeric characters.

Under this tab, you can reselect your Baud Rate, Device Address, Serial Protocol, and Full/Half Duplex, even though you may have selected different values to establish initial communications with your PC.

Set Output Mode to Command. Ignore the setting for CR(LF), Output Items, Output Filter, and Output Rate, as these items apply to digital transmission by a counter-transmitter, not to digital-to-analog conversion by the serial input transmitter.

SETTING UP COMMUNICATIONS (REMOTE C MODE)

The screenshot shows the 'Communication' tab with the following settings:

- Baud Rate:** 9600
- Address:** 1
- Output Items:** Item 1
- Output Filter:** Unfiltered
- Output Rate:** Read Rate
- Output Mode:** Command
- Incl Alarm Data:** ☐
- Include LF:** ☐
- CR (LF):** At End of All
- Serial Protocol:** Custom ASCII
- Recognition Char:** Standard *
- Remote Display "C":**
 - Start Char:** 250
 - Stop Char:** 0
 - Skip No.:** 0
 - Show No.:** 0

An 'Enter Decimal Value' dialog box is open, showing the value 250.

The above screen will appear under the Communication tab if Remote C has been selected as Display Type under the Input+Display tab. This mode is able to extract data from an ASCII string that contains multiple data values and non-numeric characters. Please see the F1 Help screen to the right.

Under this tab, you can reselect Baud Rate, Device Address, Serial Protocol, and Full/Half Duplex, even though you may have selected different values to establish initial communications with your PC.

Set Output Mode to Command. Ignore CR(LF), Output Items, Output Filter and Output Rate, as these items apply to digital transmission by a counter-transmitter, not to digital-to-analog conversion by the serial input transmitter.

The number of characters shown can be up to 7, including 6 digits and a decimal point. Include leading zeros, such as 00300.0

APPLICATION HELP

START, STOP, SHOW, SKIP

At the end of the **Display Type** list is **Remote Display "C"**, which is the selection for Masked Remote Display operation. It provides the following four selectable parameters relating to the Remote Display string of data.

- Start Char** - The character designating the beginning of the string.
- Stop Char** - The character designating the end of the string.
- Skip No.** - The number of characters following the **Start Char** to be ignored.
- Show No.** - The number of characters immediately following the ignored characters to be displayed.

Example:
 * A B C D - 1 2 3 . 4 5 E F G # H I J K * etc.

Start	Skip	Show	Stop
= *	= 4	= 7	= #

OK

SETTING UP THE ANALOG OUTPUT

The screenshot shows a software interface with five tabs: **Input+Display**, **Scaling**, **Filter**, **Relay Alarms**, and **Communication**. The **Analog Out** tab is selected. Within this tab, there is a sub-section titled **Analog Output** containing four fields:

- Source**: A dropdown menu showing **Item 3**.
- Lo Range Reading**: A text box containing **+000000.**
- Range**: A dropdown menu showing **4-20mA Current**.
- Hi Range Reading**: A text box containing **+100000.**

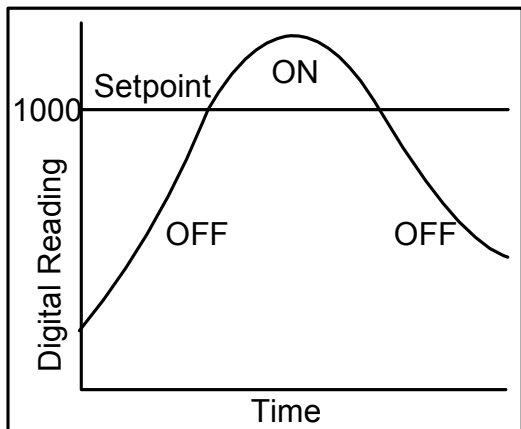
An **Enter Decimal Value** dialog box is open in the foreground. It features a numeric keypad with the following values: **+**, **1**, **0**, **0**, **0**, **0**, and **0.** Below the keypad are **OK** and **Cancel** buttons.

Under the Analog Out tab, set Source to Item 3. Under Range, select 0-20 mA, 4-20 mA, 0-10V or -10V to +10V as your desired analog output. Enter your Lo Range Reading and Hi Range Reading. These will create the two endpoint values of your analog output range. Only enter the numerical values. The decimal point is ignored. The span between the two values should be at least 256 counts.

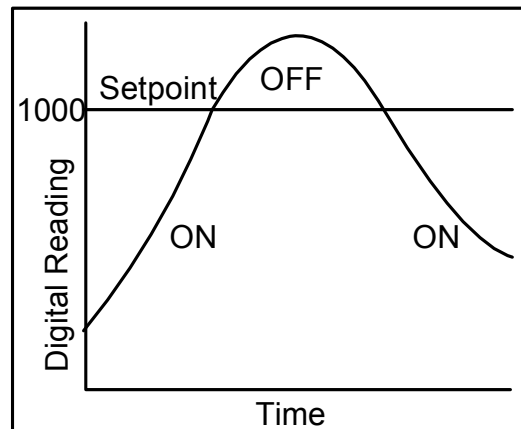
SETTING UP RELAY ALARMS OPERATION

Dual AC/DC solid state relays rated 120 mA are standard for alarm or setpoint control and are independently set up via the “Relay Alarms” tab. Set “Alarm Source” to “Item 3” as illustrated. For online help with any data entry field, press the **F1** key.

- Setpoint.** The number to which the current reading is compared if deviation is set to zero. The reading is the count in engineering units that is transmitted digitally and is also used for analog output. For example, if the transmitted reading is in gallons/minute, the setpoint will be referenced to that reading, not to the raw pulse rate sent from a turbine flow meter.

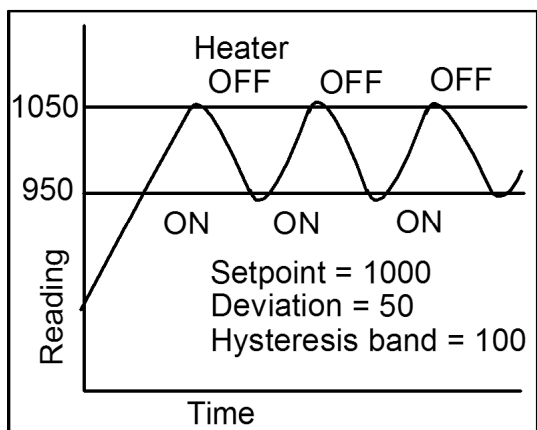


*“Active High” On/Off setpoint control
with deviation = 0*

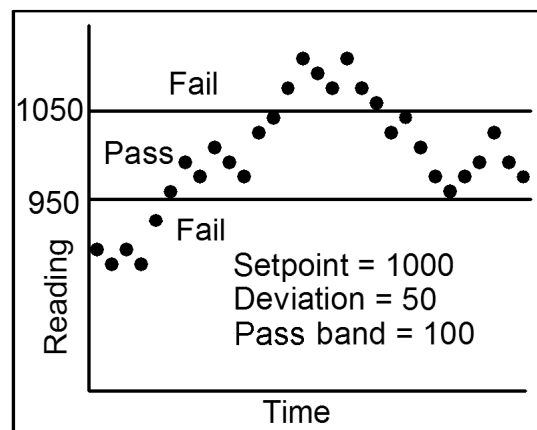


*“Active Low” On/Off setpoint control
with deviation = 0*

- **Deviation.** A positive number that can be added or subtracted from the setpoint, depending on the Deviation Type, to determine when an alarm becomes Active or Inactive.
- **Alarm Source.** Depending on the Signal Input Mode and Function selected under the Input+ Display tab, the alarm can be assigned to any of up to three Items, for example to Item 1 (A rate / B rate), Item 2 (A rate), or Item 3 (B rate).
- **Alarm State.** If “Active High” is selected, the Active Alarm State is defined as being above the setpoint. If “Active Low” is selected, the Active Alarm State is defined as being below the setpoint. If “Disabled” is selected, the Alarm State is always inactive.
- **Relay State.** A setting with ties the Relay State to the Alarm State. If “Active On” is selected, the relay will be closed when the Alarm State is 1. If “Active Off” is selected, the relay will be open when the Alarm State is 1.
- **Deviation Type.** Three choices are offered: Split Hysteresis, Span Hysteresis, and Band Deviation. These define how Setpoint and Deviation are to be combined to set Alarm State.



Span Hysteresis for heater control



Band Deviation for component testing

In Split Hysteresis, the relay opens (or closes) when the reading goes above the Setpoint plus one Deviation, and closes (or opens) when the reading falls below the Setpoint less one Deviation. Two Deviation limits lie symmetrically around the Setpoint to create a deviation band. A narrow hysteresis band is often used to minimize relay chatter. A wide band can be used for on-off control.

In Span Hysteresis, operation is as for Split Hysteresis, except that the Setpoint is always on the high side, and a single Deviation lies below the Setpoint to create the hysteresis band. Span Hysteresis is considered by some to be more intuitive than Split Hysteresis.

In Band Deviation, the relay opens (or closes) when the reading falls within the deviation band, and closes (or opens) when the reading falls outside. Two deviation limits lie symmetrically around the setpoint to create the deviation band. Passbands around a setpoint are often used for go-no-go component testing.

- **Alarm Type.** Selections are Non-Latching and Latching. Under Non-Latching, the relay is only closed (or open) while the Alarm State is Active. Under Latching, the activated relay remains closed (or opens) until reset regardless of the Alarm State. Resetting is normally achieved by temporarily grounding one of the transmitter's control inputs, which has been set to Function Reset under the "Input+Display" tab.
- **Alarms 1,2 No. Rdgs to Alarm.** Selections are binary steps from 1 to 128. This is the number of consecutive alarm readings that must occur to create an Active alarm. Numbers higher than 2 provide some Alarm filtering so that 1 or 2 noisy readings do not cause an Active Alarm. The Alarm becomes Inactive if one of the consecutive readings fails to be an Alarm reading. The Alarm readings counter then resets to 0.

9. PUTTING YOUR PROGRAMMED SETUP INTO THE LTS6

After you have completed all of your settings in Instrument Setup Software, click on the Main Menu button. From the Main Menu, click on the Counter tab and do a Put Setup. This will download your setup from the PC into the LTS6. Then exit Instrument Setup Software completely and disconnect your LTS6.

REMOTE C WARNING:

Failure to exit Instrument Setup software completely will take the LTS6 out of the Remote C mode back into the Remote A mode, which allows two-way serial communications between the PC and LTS6.

Reconnecting the LTS6 to a PC and using Instrument Setup Software, for example to check on previously programmed settings, will also take the LTS6 out of the Remote C mode back into the Remote A mode. In that case, you will need to reset the LTS6 to Remote C and do a Put Setup to download your setup from the PC into the LTS6.

10. MODBUS PROTOCOL TRANSMITTER COMMUNICATIONS

1. GENERAL

The Modbus capability conforms to the Modbus over Serial Line Specification & Implementation guide, V1.0. Both the Modbus RTU and Modbus ASCII protocols are implemented:

Modbus RTU

Baud Rate..... 300, 600, 1200, 2400, 4800, 9600 or 19200
Data Format 1 start bit, 8 data bits, 1 parity bit, 1 stop bit (11 bits total)
Parity..... None, Odd, Even (if None, then 2 Stop bits for 11 total)
Address..... 0 for broadcast, 1-247 for individual devices

Modbus ASCII

Baud Rate..... 300, 600, 1200, 2400, 4800, 9600 or 19200
Data Format 1 Start bit, 7 Data bits, 1 Parity bit, 1 Stop bit (10 bits total)
Parity..... None, Odd, Even (if None, then 2 Stop bits for 10 total)
Address..... 0 for broadcast, 1-247 for individual devices

2. FRAMING

Modbus RTU: Message frames are separated by a silent interval of at least 3.5 character times. If a silent interval of more than 1.5 character times occurs between two characters of the message frame, the message frame is considered incomplete and is discarded. Frame Check = 16 bit CRC of the complete message excluding CRC characters.

Modbus ASCII: The message begins immediately following a colon (:) and ends just before a Carriage Return/ Line Feed (CRLF). All message characters are hexadecimal 0-9, A-F (ASCII coded). The system allowable time interval between characters may be set to 1, 3, 5 or 10 seconds. Frame Check = 1 byte (2 hexadecimal characters) LRC of the message excluding the initial colon (:) and trailing LRC and CRLF characters.

3. ELECTRICAL INTERFACE

Two-wire (plus common) half-duplex RS485 or RS232 signal levels are jumper selectable on the transmitter main board. The RS485 selection provides a jumper selection for insertion of a line termination resistor. Please see Section 14. In case of a long line (greater than 500 ft) to the first device, a termination resistor should be selected for the first device. In case of a long line between the first and last devices, a termination resistor should be selected for the first and last devices. Never add termination resistors to more than two devices on the same line.

4. COMMUNICATIONS SETUP

Parameters selectable via downloaded Instrument Setup software:

Serial Protocol Custom ASCII, Modbus RTU, Modbus ASCII
Modbus ASCII Gap Timeout..... 1 sec, 3 sec, 5 sec, 10 sec
Baud Rate..... 300, 600, 1200, 2400, 4800, 9600, 19200
Parity No parity, odd parity, even parity
Device Address 0 to 247

5. SUPPORTED FUNCTION CODES

FC10: Write Multiple Registers (FC10 = 16 dec)

Writes internal registers containing input data for analog output and relays.

Register Address		Data Type	Destination
Dec	Hex		
107	006B	Hi Word Hex Value	Hi Word Applied to Item3
108	006C	Lo Word Hex Value	Lo Word Applied to Item3

FC05: Write Single Coil

Action command to transmitter

Output Address	Output Value	Action Command
00 01	FF 00	Transmitter Reset (No Response)
00 03	FF 00	Latched Alarm Reset

6. MESSAGE FORMATTING

MA = Device Address	DD = Data (Hex)	CL = CRC Lo Byte
FC = Function Code	WW = Data (On/Off)	CH = CRC Hi Byte
RA = Register Address	SF = Sub-Function	CR = Carriage Return
NR = Number of Registers	EC = Error Code	LF = Line Feed
NB = Number of bytes	LRC = ASCII Checksum	

Modbus RTU Format

FC	Action	> 3.5 Char	Byte Number										
			1	2	3	4	5	6	7	8	9	10	11
05	Request	NoTx	MA	FC	RA	RA	WW	WW	CL	CH			
05	Response	NoTx	MA	FC	RA	RA	WW	WW	CL	CH			
10	Request	NoTx	MA	FC	RA	RA	NR	NR	NB	DD*	DD*	CL	CH
10	Response	NoTx	MA	FC	RA	RA	NR	NR	CL	CH			

Modbus ASCII Format

FC	Action	Byte Number												
		1	2	3	4	5	6	7	8	9	10	11	12	13
05	Request	:	MA	FC	RA	RA	WW	WW	LRC	CR	LF			
05	Response	:	MA	FC	RA	RA	WW	WW	LRC	CR	LF			
10	Request	:	MA	FC	RA	RA	NR	NR	NB	DD*	DD*	LRC	CR	LF
10	Response	:	MA	FC	RA	RA	NR	NR	LRC	CR	LF			

Message Examples for Device Address = 01, No Parity

Example	Action	Modbus RTU	Modbus ASCII
		Ser_4 = 010 Addr = 001	Ser_4 = 020 Addr = 001
Send -12.34 to LTS **	First send decimal point, address 0057 as 00 03.		
	Request	01100069000204FFFFFB2E F6E5	:01100069000204FFFFFB2E 59 crLf
	Response	011000690002 91D4	:011000690002 84 crLf

** 1234 decimal = 000004D2 hex. -1234 = FF FF FB 2E in 4-byte 2's complement hex.
Decimal point is ignored.

RTU: Bolded last 4 characters indicate the CRC (added automatically by the device).

ASCII: Bolded last 2 characters indicate the LRC ((added automatically by the device).

11. CUSTOM ASCII PROTOCOL TRANSMITTER COMMUNICATIONS

All setup parameters are entered into the transmitter via Instrument Setup (IS) software, including the serial communication format, digital address, operating mode, analog output scaling, and relay operating modes and setpoints.

1. SERIAL COMMUNICATION FORMAT

The Custom ASCII serial communication format for both RS232 and RS485 is the following:

Modes.....Full Duplex (separate transmit and receive lines) or Half Duplex (RS485 only).

Baud Rate300, 600, 1200, 2400, 4800, 9600, 19200 selectable with IS software.

Data Format8 data bits, no parity, 1 stop bit

2. DATA FORMAT

The basic input data format consists of 9 or 10 ASCII characters, such as +9999.99A<CR>. The first character is always a plus or minus sign. There are 6 numeric digits. A decimal point is always required, even when it follows the last digit. The letter A is an optional alarm character. <CR> is the carriage return character. A line feed <LF> character at the end of the string is ignored.

3. NETWORK CONFIGURATIONS

Using the Custom ASCII protocol, serial input transmitters can operate in a point-to-point mode using RS232 or RS485, or in a multi-point mode using RS485:

The point-to-point mode is a direct connection between a computer (or other digital device) and the transmitter. It is suggested that address 1 be selected for the point-to-point mode.

The multi-point mode is a connection from a host computer to multiple transmitters bused together with their inputs and outputs connected in parallel. It is necessary to set up each device on the bus with a different address from 1 to 31. To command a particular device, its address is used in conjunction with the command, and only that device will respond. The outputs of all devices on the bus are set to a high impedance state, except the device being addressed. Zero (0) is a special address to which a device responds only internally (e.g. Reset), but it does not transmit any response on the output lines. All devices may be commanded simultaneously with a 0 address, and there will not be any output response contention.

4. OPERATING MODES

The serial input transmitter has three serial input modes, which are dedicated to the analog output and relays based on serial data received via RS232 or RS485:

Remote A Addressable remote units (up to 31 units)

Remote S Single remote unit

Remote C Single remote unit programmed to select specific data from a data string.

Remote A is an addressable input mode that uses the K command letter. It can convert remote data on one or more transmitters having the command address in a multi-point configuration or a single transmitter having the command address in a point-to-point configuration.

Remote S is not addressable, and data representing a value to be retransmitted as an analog output is received via a point-to-point connection. The value is stored where it may be selected for Alarm comparisons. If a Coded Alarm character is included, it overrides the internal alarm comparisons.

Remote C is used to extract data from an ASCII string that contains multiple data values and non-numeric characters. It can accommodate selected Start and Stop characters. Any number of characters after the start character can be masked off up to the beginning of the desired data. From 1 to 6 numeric characters can be selected for the data (8 characters if sign and decimal point are included). The following parameters determine the operation:

1. Start character. This can be any ASCII character in the received string. It must be at a fixed number of characters from the beginning of the desired data, which must have a fixed number of characters. Enter 00 if no start character is available. The stop character then becomes the start character.
2. Stop character. Set to 00 if no stop character is available. Note: Only either the start or stop character can be set to 00. The start and stop characters cannot be any character included in the data string.
3. Skip No. Number of characters following the Start character to be ignored.
4. Show No. Number of characters following the ignored characters to be processed.



Warning: Instrument Setup (IS) software sets the mode to Remote A when first accessing the transmitter or performing a *Get Setup* command. This is because the transmitter will not communicate with the host PC using IS software in the Remote C mode. The user must reset the mode to Remote C prior to executing a *Put Setup* command, which will load the setup information into the transmitter.

If you desire the transmitter to operate in the Remote C mode and you later need to perform a *Get Setup* command to change a setup parameter, do not forget to change the transmitter back from Remote A to Remote C prior to performing a *Put Setup* command.

Remote A Data Format: *#KSDDDDDD.A<CR>

- *** = Recognition character. Another command recognition character may be chosen to make the transmitter compatible with an existing system. The transmitter will still respond to an asterisk.
- #** = Device address. See Address Codes table on next page.
- K** = Command letter.
- S** = Sign of value (optional), space (or +) for positive, - for negative value.
- D** = Data. Number of digits can be 1-6.

- . = Decimal point (optional).
- A** = Alarm Character (optional). A = no alarms, B = alarm 1 active, C = alarm 2 active, D = alarms 1 & 2 active.
- <CR>** = Carriage return character

Remote S Data Format: **SDDDDDD.A<CR>**

- S** = Sign of value (optional), space (or +) for positive, - for negative value.
- D** = Data. Number of digits can be 1-6.
- . = Decimal point (optional).
- A** = Alarm Character (optional). A = no alarms, B = alarm 1 active, C = alarm 2 active, D = alarms 1 & 2 active.
- <CR>** = Carriage return character

Remote C Data Format: **STXXXSDDDDDD.SP**

- ST** = Start character
- XXX** = Data to be ignored (Skip No.)
- S** = Sign of value (optional), space (or +) for positive, - for negative value.
- D** = Data. Number of digits can be 1-6 (Show No.)
- . = Decimal point (optional).
- SP** = Stop character

CHAR 2 - Address Codes for Remote A

A Serial Communications Address Code from 1 to V follows the “*” to indicate the device address number from 1 to 31.

Device #	Address Code
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B

Device #	Address Code
12	C
13	D
14	E
15	F
16	G
17	H
18	I
19	J
20	K
21	L
22	M

Device #	Address Code
23	N
24	O
25	P
26	Q
27	R
28	S
29	T
30	U
31	V

12. SPECIFICATIONS, SERIAL INPUT TRANSMITTER

Serial Data Input

Signal Levels..... RS232, full-duplex RS485, half-duplex RS485 (selectable)
Protocol Modbus RTU, Modbus ASCII, Custom ASCII (software selectable)
Serial Connector Detachable dual 3-position plugs

Analog Output (standard)

Output Levels..... 0-20 mA, 4-20 mA, 0-10V, -10V to +10V (selectable)
Compliance at 20 mA..... 10V (0-500 ohm load)
Compliance at 10V..... 2 mA (5 kohm minimum load)
Output Resolution..... 16 bits (65,535 steps)
Output Error..... < 0.02% of full span
Output Update Rate Determined by serial input rate. Approx 75/sec max at 19200 baud

Dual Relay Output (standard)

Relay Type Two solid state relays, SPST, normally open, Form A
Load rating 120 mA at 140 Vac or 180 Vdc
Relay modes Active high or low, latching or non-latching, hysteresis or band deviation

Power & Electrical

Power to Transmitter 85-264 Vac or 90-300 Vdc (standard power)
12-30 Vac or 10-48 Vdc (low voltage power option)
Power Isolation..... 250 Vrms between power, analog output, signal input, and serial I/O

Transmitter Setup

Transmitter setup Instrument Setup software using PC and CBL04 cable

Mechanical

Case Dimensions 129 x 104 x 22.5 mm
Case Mounting..... 35 mm DIN rail per EN 50022
Electrical Connections..... Detachable screw plug connectors

Environmental

Operating Temperature 0°C to 55°C
Storage Temperature -40°C to 85°C
Relative Humidity..... 95% from 0°C to 40°C, non-condensing

13. WARRANTY

Laurel Electronics Inc. warrants its products against defects in materials or workmanship for a period of one year from the date of purchase.

In the event of a defect during the warranty period, the defective unit may be returned to the seller, which may be Laurel or a Laurel distributor. The seller may then repair or replace the defective unit at its option. In the event of such a return, freight charges from the buyer shall be paid by the buyer, and freight charges from the seller shall be paid by the seller.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from:

1. Improper installation or miswiring.
2. Improper or inadequate maintenance.
3. Unauthorized modification or misuse.
4. Operation outside the environmental specifications.
5. Mishandling or abuse.

The warranty set forth above is exclusive and no other warranty, whether written or oral, is expressed or implied. Laurel specifically disclaims implied warranties of merchantability and fitness for a particular purpose.

Any electronic product may fail or malfunction over time. To minimize risks associated with reliance on Laurel products, users are expected to provide adequate system-level design and operating safeguards. Laurel's products are intended for general purpose industrial or laboratory use. They are not intended nor certified for use in life-critical medical, nuclear, or aerospace applications, or for use in hazardous locations.

EXCLUSIVE REMEDIES

The remedies provided herein are Buyer's sole and exclusive remedies. In no event shall Laurel be liable for direct, indirect, incidental or consequential damages (including loss of profits) whether based on contract, tort, or any other legal theory.