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PRELIMINARY INFORMATION

IRSFC24T ISOLATED AUTOMATIC CONVERTER with INTELLIGENT DETECTION and DISPLAY of INTERNAL/EXTERNAL ERROR CONDITIONS

Master-Slave Software Version (01.0A, 7-29-99) and,
Bi-directional Software Version (01.0A, 8-19-99)

The IRSFC24T is an isolated, automatic converter that enables an RS-232 port to send and receive RS-485 data. Five LED indicators show system status and quickly identify the source of problems without requiring additional diagnostic equipment.

Two versions are available that are designed for either Master-Slave or Bi-directional communications.

The Master-Slave version is designed to monitor communications that originate at the Master-RS232 side of the interface. A response is expected back from an RS485 Slave device within a “reasonable” period of time (approximately 50uSec to 20Sec).

The Bi-directional version simply displays the TX and RX functions independently without timing out.

The IRSFC24T has many features and abilities that will solve problems, save time and aggravation in designing, installing, and maintaining an RS485 link or network.

The converter introduces no communications delays and does not depend on any communications protocol. Baud rates, parity, number of data bits, check sums, timing, handshaking, and control characters do not affect the converter's automatic operation.

CHARACTERISTICS:

- Conversion between full-duplex RS232 and half-duplex (2-wire) RS485. Use a PC's standard serial port for RS485 communications. No need for internal expansion cards or special software.
- Automatic Enable control is standard. No need for software control of the RS485 transmit-enable signal. Unlike other converters, the IRSFC24T transmits data “on the fly” and reverts back into a receive mode with minimum delay. This allows for fast half-duplex operation without introducing delays into your system.
- Continuous monitoring and display of line status by an onboard microprocessor. LED indicators quickly verify proper operation and identify the source of problems.
- Galvanic isolation of the RS485 link. There is no ohmic connection between the RS485 line and the host computer.
- Built-in transient protection from voltage surges on the RS485 line.

- Operation at Baud rates up to 115,200 using virtually any asynchronous communications specification (data bits, stop bits, parity).

SETUP

In addition to the converter, you'll need a power supply, an RS232 cable to your PC, and a connection to your RS485 network. Accessories are available from R.E. Smith.

The converter's RS-232 port typically connects to the RS232 port of a host computer that controls the RS485 link or network. The host may be a PC or any computer with an RS232 interface.

The converter's removable terminal strip connects to the RS485 line, which in turn connects to one or more target devices in your network.

To connect to the host computer, use a cable with a 6-wire RJ11/12 modular phone connector and a mating connector for the host's RS232 connector. On most PCs, this connector is a DB9M (9-pin, male D-shell), so the cable requires a DB9F (9-pin, female D-shell). Some PCs have a DB25M (25-pin, male D-shell).

Required Connections:

Signal	RJ-11 (6P6C)	DB9F	DB25F
CTS (IN)	PIN-1	PIN-8	PIN-5
RTS (OUT)	PIN-2	PIN-7	PIN-4
SG (COM)	PIN-3	PIN-5	PIN-7
TD (OUT)	PIN-4	PIN-3	PIN-2
RD (IN)	PIN-5	PIN-2	PIN-3
DSR (IN)	PIN-6	PIN-6	PIN-6

The host's RS232 port requires three lines: TD (transmitted data), RD (received data), and SG (signal ground). No other signals are required by the converter. Note: It might be necessary to disable handshaking signals at you PC to insure proper operation.

To connect to the RS485 line, use the removable 3-pin terminal strip. Long RS485 links typically use twisted-pair cable. Use 120-Ohm characteristic impedance cable for best results. Shielded wire is also highly recommended.

The RS485 cable must have a minimum of two wires: two data lines (+ and -) and an optional common (ground). To enable the onboard transient protection network to operate properly, provide a low impedance path to a local earth ground. This will allow the onboard transient protection network to work at its full potential. The optional common can also be used to connect to one end of a shield; however, this could have the unwanted effect of coupling destructive induced voltages and currents into the converter in some cases.

The IRSFC24T's, RS485 port may be connected to an additional 31 targets devices to form a serial network. Repeaters are available to extend both the distance and number of devices on the network.

The converter uses a 9V DC, 200mA power supply, which plugs into the provided jack on the shorter side of the enclosure. To use the converter, connect the cables as described above and apply power to all of the units in the network.

The converter's terminating network assumes the use of cable with 120 ohms characteristic impedance on the RS485 line. The last unit (each end) in the link should have a 120-ohm resistor connected across the two RS485 data lines. Bias should be provided at some point in the network. Bias in the “center” of the network will hold the data lines in a known state when data is not being sent. In the alternative, double bias can be added at each end of the network along with the terminating resistors. Care should be taken to insure that extra bias and/or termination is not applied. By NOT removing the additional jumpers the load on the line will become excessive and communications will be limited to fewer units than specified.

If the converter is not at the end of the line, remove the terminating resistor by removing J7 in the converter. Also, remove jumpers J5 and J6 to remove the Bias Resistors.

THE LED INDICATORS

Five LED indicators show system status. From left to right on the enclosure, the LEDs are GRN2, YEL, RED2 and GRN1 with RED1 on the far right. Three of the LEDs are driven by the onboard microprocessor, while GRN1 and RED1 monitors the RS232 signals directly.

RED2 is on when the converter is sending data to the target or waiting for a response from the target. RED2 may flashes to indicate an internal microprocessor error or a specific external short condition (remove the terminal strip – if flashing stops the error is most likely external in nature).

GRN2 is on when the converter is receiving RS485 data from the target device. YEL indicated power is on and the

converter is operating. YEL flashing indicated that no data has been sent from the host computer for about 20 seconds.

While in normal operation it appears that all LEDs are active, there is a specific sequence of events that occurs. If this sequence is not completed the LEDs will help identify the cause of the problem(s). In a typical communications transaction the host computer will transmit a command on the RS232 port. This action causes the GRN1 indicator on the converter to turn on, indicating that data is present at the converters RS232 receiver.

At this time the YEL indicator turns off and the RED2 indicator turns on indicating, 1) that the converter is transmitting RS485 data to the target device, or 2) that the RS485 data has been transmitted, and the converter is waiting for a reply from the target device. A solid RED2 indicator generally means that the target device is NOT responding.

While the target device is sending a response, the GRN2 indicator will be active, indicating that RS485 data is being received. This action will cause the RED2 indicator to turn off. While data is being receiver from the target RS485 device the RED1 indicator will be on indicating that the data is being transferred to the host computers RS232 port.

When the target device is no longer sending data the YEL indicator will be on and all other indicators will be off indicating that the transaction is complete. If no additional data is sent by the host computer, the YEL indicator will start to flash after about 20 seconds (5 seconds on power up). If an error condition occurs, such as the target device does not responding, the converter will clear the error (after about 20 seconds) and flash the YEL indicator.

USING THE CONVERTER

When the IRSFC24T powers up, the YEL LED lights. After 5 seconds, if the converter receives no data from the host computer, the YEL LED begins to flash.

A typical communications cycle between a host and target is as follows:

1. The host sends a command string or other data to the converter, which transmits the data to the target (on-the-fly). RED2 is on while the data is transmitting.

2. When the target device receives the data it responds by sending data back to the converter, which in turn transmits the data to the host. The GRN2 and RED1 LEDs are on while this data is being sent.

3. When the target has finished transmitting, and the RS485 line returns to an idle condition, the YEL LED turns on.

4. If the host sends no additional data for 20 seconds, the YEL LED starts to flash and continues flashing until the unit detects new data from the host and a new cycle begins.

In normal operation, with normal/high Baud rates and minimal delays between communication cycles, all five LEDs will appear to flash continuously.

ISOLATING PROBLEMS

The LEDs can help to determine and isolate the source of problems, causing a fault, in your network.

Areas where hardware problems may occur are the host computer, the host/converter cable, the converter, the converter/target cable, and the target device itself.

When a problem occurs, the frustrating part is figuring out where to start looking! With the IRSFC24T and a little deductive reasoning you can isolate most problems to a specific area of the communications cycle or hardware. Because the converter is in the middle of the link between an RS232 port and the network, it's in an excellent location to identify and isolate problems.

POSSIBLE SOURCES OF ERROR:

- Wiring problems
- Baud rate mismatch
- Communications protocol mismatch (parity, number of bits, stop bits)
- Phasing problems in the RS485 wiring
- Defective components
- Power not applied to all units
- Wrong address being sent to target
- Wrong commands being sent
- Incorrect cables
- Handshaking signals not in correct states (off)
- Noise and external interference
- Improper termination and/or bias
- Cable with improper characteristic impedance
- Cable too long (use a repeater)
- More than 32 “nodes” on a network (use a repeater)
- "T" connections on the network causing reflections (use a repeater or rewire)
- Excess loading (too many terminators/bias)

LED TROUBLESHOOTING GUIDE

Display	Reason	Fault Location
YEL flashing	The converter has not received data from the host for 20 seconds.	Normal operation if the host is not transmitting. If the host is transmitting, the problem is between the host and the converter.
RED2 on solid, GRN2 off	The converter is receiving continuous data from the host or the target device is NOT responding.	Problem between converter and target. Check host and target software, target hardware.
RED2 flashing		Problem in the target or in the cable between the converter and target. Check cables. If RED2 continues to flash after removing RS485 cable at the converter, the converter's RS485 driver may be defective.
GRN2 flashes, RED1 off	The converter is receiving data from the target but is not sending the data to the host.	Defective RS232 driver in the converter.
Indicators are normal but the link doesn't work.	The host isn't receiving from the converter or the converter isn't sending data to the host.	Cable problem between host and converter. Defective RS232 receiver in host and/or RS232 transmitter in converter .

If a single fault occurs and the next cycle is OK the converter automatically resumes normal display indications. If a fault occurs that is not corrected by another cycle, the fault indication persists. If no data is exchanged for 20 seconds the converter automatically resets and the YEL LED begins to flash.

For example, if the YEL LED is flashing and the host computer is sending data, a problem exists somewhere between the host RS232 transmitter and the RS232 receiver within the converter. This isolates the problem to the host, the host's cable, or the converter. Once this problem is corrected, the network should either begin to work properly or the LEDs will display another fault.

With the current firmware the monitoring function should operates at Baud rates up to 115.2k. At the higher Baud rates (above 38.4K) the monitoring function could become erratic (due to processor speed), but the converter circuits will continue to operate normally.

Note: The processor can be removed from the socket and the unit will still operate normally as a converter. The RED2, YEL, and GRN2 indicators will NOT operate with the processor removed and will be off.

With automatic control of the RS485 Transmitter Enable, the IRSFC24T converter is ready to receive a target's reply as soon as it's available. The target doesn't have to delay before replying. In some rare instances using very fast target devices (and higher baud rates) a half-bit data “collision” can occur. Contact us if this happens and we can recommend a timing change in the converter that will correct this problem.

TABLE OF SPECIFICATIONS FOR COMMON COMMUNICATIONS STANDARDS:

SPECIFICATIONS		RS232	RS423	RS422	RS485
Mode of Operation		SINGLE-ENDED	SINGLE-ENDED	DIFFER-ENTIAL	DIFFER-ENTIAL
Total Number of Drivers and Receivers on One Line		1 DRIVER 1 RECVR	1 DRIVER 10 RECVR	1 DRIVER 10 RECVR	1 DRIVER 32 RECVR
Maximum Cable Length		50 FT.	4000 FT.	4000 FT.	4000 FT.
Maximum Data Rate		20kb/s	100kb/s	10Mb/s	10Mb/s
Maximum Driver Output Voltage		+/-25V	+/-6V	-0.25V to +6V	-7V to +12V
Driver Output Signal Level (Loaded Min.), (Unloaded Max.)	Loaded	+/-5V to +/-15V	+/-3.6V	+/-2.0V	+/-1.5V
	Unloaded	+/-25V	+/-6V	+/-6V	+/-6V
Driver Load Impedance (Ohms)		3k to 7k	>=450	100	54
Max. Driver Output Current in High Impedance State	Power On	N/A	N/A	N/A	+/-100uA
	Power Off	+/-6mA @ +/-2v	+/-100uA	+/-100uA	+/-100uA
Slew Rate (Max.)		30V/uS	Adjustable	N/A	N/A
Receiver Input Voltage Range		+/-15V	+/-12V	-10V to +10V	-7V to +12V
Receiver Input Sensitivity		+/-3V	+/-200mV	+/-200mV	+/-200mV
Receiver Input Resistance (Ohms)		3k to 7k	4k min.	4k min.	>=12k