Telog Data Recorders

User Guide

R-3000 Series

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Table of Contents

List of Tables iii
List of Figures iv
Assumptions v
Feedback to Telog v
Product Registration v
Organization of this Guide v
Unpacking Your System vi
Cleaning Your System vi

Section 1. Telogers: R-3000 Series Recorders 1–1

Overview 1–1
Specifications 1–2
Analog Channel Inputs 1–4
Input Types 1–4
Voltage 1–4
Current loop 1–4
RTD 1–5
Thermocouple 1–5
Ambient Temperature 1–5
Excitation 1–5
Procedure to perform a calibration test 1–6
Schematics 1–7
Digital Channel Inputs 1–10
Summary 1–10
Pulse 1–10
Event 1–10
Installation considerations 1–10
Schematics 1–11
Data Collection 1–12
Power Options 1–13
Summary 1–13
Battery Life Considerations 1–14
Procedure to compute battery life 1–14
Alarms 1–16
Modem Module 1–18
Procedure to install the modem 1–18
General U.S. FCC information 1–18
Canada Department of Communications Notice 1–19

Assumptions

This User Guide contains information for setting up the Telog R-3000 series, R-2100 series and LC-800 series data recorders. This guide provides information on hardware features that are appropriate when using Telogers for Windows for programming and collecting data using these recorders. For information on using the support software appropriate for your type(s) of recorder(s), refer to the corresponding user guide: for S-3PC use the Telogers for Windows User Guide, for S-21PC use the R-2100 Series User's Manual and for S-8PC use the Linecorder LC-800 Series User's Manual.

Feedback to Telog

All of our products are the result of efforts by the engineering, marketing, and production staffs of Telog Instruments, Inc. We are eager to know what you think of our recorders, the software and our user guides. We are constantly seeking ways to improve our products based on your comments and experiences. Many of our ideas for improvement to existing products and ideas for new products come from you. Call, fax or write to use at the information on the front cover.

Product Registration

To register your recorder(s) and software with Telog, complete and return the registration card located in the front of this guide. We provide technical support for registered users. In addition, we notify registered users of product upgrades and may offer you the opportunity to purchase upgrades at substantial savings.

Organization of this Guide

This guide contains a section for each series of Telog's recorders and the optional Data Transfer Unit. You will find information for installation, setup, use and specifications for each type of recorder. Refer to the table of contents for the section that describes the type of recorder(s) for which you want information.

Unpacking Your System

Some suggestions for unpacking your system are provided below.

- Please unpack each package of the shipment carefully. Be sure to remove all items. Small items such as cables and batteries are easily overlooked.
- Compare the total received shipment contents with the packing list. Contact Telog if items are either missing or different from the packing list.
- Save the shipping cartons, boxes, etc. They can be reused if you need to return a recorder for service.
- Carefully inspect all items for shipping damage.
  If you received a sensor or transmitter with your recorder, inspect the sensing elements by unscrewing the black plastic tip of the sensor or transmitter and visually inspect the crystal diaphragm for cracks or other obvious physical damage, then replace the tip.
- Do not attempt to install or use any damaged item. If items were damaged in shipment, contact the shipper for assistance.

Cleaning Your System

Information for routine cleaning of Telog recorders is provided here. Additional information for cleaning and decontaminating e-series recorders if they are exposed to known or potential health hazards is described in Section 3.

Note:	Telog reserves the right to withhold service from any product until proper cleaning and decontamination have been accomplished and certified.

To perform routine cleaning, wipe the enclosure of the recorder with a water-dampened cloth. If needed, use a mild detergent, then wipe the detergent with a water-dampened cloth. Wipe excess water from around the connectors. Allow the water to evaporate thoroughly before returning the recorder to service.

Section 1. Telogers: R-3000 Series Recorders

Overview

The Telogers data acquisition system is designed to perform automatic data collection from remote locations. A minimum system configuration consists of at least one R-3000 series (Teloger) recorder, Telogers for Windows (S3-PC) support software running on a personal computer and a data transfer cable (C-21ATC). A more common system configuration consists of several (five, 50, or even 300) Telogers sharing Telogers for Windows.

There are several models of Teloger recorders in the R-3000 recorder series. The model number identifies the number of independent channels for data collection. Appendix A and Table 1-1 provide information on each model in the R-3000 series, sensors and accessories for a Telogers system.

Each Teloger consists of a circuit board packaged in a bent metal enclosure for panel mounting. The recorder's face-plate contains information on connections for power, telephone and signal inputs. Optional NEMA 4X enclosures are available to fit your specific application requirements.

Program each R-3000 using Telogers for Windows. The R-3308 recorder channels are completely software programmable. The R-3307 and R-3314 recorders have hardware switches that set the analog channels to collect either current or voltage information. The R-3303 recorder does not have analog channels. Information on setting the hardware switches is provided later in this section.

If your R-3000 Teloger has the optional M-324 modem module or an external modem, you can reprogram and collect data using remote communications. If the recorder does not contain the module or an external modem, use the data transfer cable for local (direct) connection to the computer running Telogers for Windows (S3-PC) to program and collect data.

Refer to the Telogers for Windows User Guide for information on setting up, programming and collecting and analyzing data from an R-3000 recorder.

Specifications

Table 1-1. R-3000 Series Recorder Specifications

	R-3314	R-3308	R-3307	R-3303
Recorder Channels				
Channels	14 total - 8 analog and 6 pulse/event	8 total - 4 analog, 3 pulse/event and 1 ambient temperature	7 total - 4 analog and 3 pulse/event	3 total, pulse or event
Memory	256K or 512K RAM total, dynamically allocated among active channels			
Analog inputs only	127,980 or 289260 12-bit data values	137,700 12-bit data values	70,560 or 151,200 12-bit data values	*NA*
Pulse inputs only	95,985 or 216,945 16-bit data values	103,275 16-bit data values	52,920 or 113,400 16-bit data values	52,920 or 113,400 16-bit data values
Event inputs only	31,995 or 72,315 events	34,425 events	17,640 or 37,800 events	17,640 or 37,800 events
Storage	Wrap-around (FIFO, first-in, first-out)			
Analog Inputs Type	User selectable			*NA*
Voltage	Bipolar or unipolar: 100 mV, 200 mV, 500 mV, 1, 2, 5, 10, or 20 V; or unipolar 1–5 V			
Current	Bipolar or unipolar: 1mA, 20 mA; or unipolar 4-20 mA			
Ambient temperature	*NA*	See Table 1-2 that follows	*NA*	
RTD				
Thermocouple				
Input Impedance				
Voltage input	1Mohm to ground (+ and – inputs)			
Current mode	200 ohms loop impedance	100 ohms loop impedance	200 ohms loop impedance	
Common Mode Rejection	± 4 Vdc on 1V or lower voltage ranges and 1 ma current range ± 40 Vdc on 2V or higher voltage ranges and 20 ma current range			
Excitation	*NA*	On time for 5 ms to 400 ms; voltage or current, selectable to suit transmitter used: 5 or 12 volts (20mA max.), or 1mA (1Vmax)	*NA*	
Resolution	12 bits (0.025% of FS)			
Accuracy	± 0.05% for 100 mV ranges and above; ±0.1% for ranges below 100mV; ±50ppm/°C			
Analog and Temperature Sampling				
Sample rate	Once/s to once every 8 h for each channel			
Sample interval	1 s to 8 h, synchronized to midnight, channel independent			
Values saved	Minimum, average and/or maximum per interval			
Totalizers	1 six-byte totalizer per channel			

Table 1-1. R-3000 Series Recorder Specifications (cont.)

Pulse/Event Inputs	
Type	Pulse counting or event recording, user selectable
Input	Uncommitted contact or active logic signals
Excitation	10µA contact sensing current; 5 volt pull-up
Contact bounce	3 ms, software programmable bounce filter
Pulse Sampling	
Low speed rate	100/s with bounce filter
High speed rate	20,000/s with no bounce filter
Total interval	1 s to 8 h, synchronized to the hour, channel independent
Values saved	Totals, overall and per interval
Event Sampling	
Event rate	1 event/s maximum
Values saved	Event with time stamp (mm:dd:yy:hh:mm:ss), and computed run time
Alarms	
Activation	any channel
Outputs	for R-3303 and R-3307: 1 high and 1 low; for R-3308 and R-3314: high/high, high, low and low/low
Type	Open collector transistor
Maximum voltage	30 V
Maximum current	100 mA
Resolution	0.025% of FS
Power	
Local battery type and life	Lithium battery pack with MTA connector: 10V 1.8Ah pack for R-3303, R-3307 and R-3314, 9V 3.6Ah pack for R-3308. Life of 6 months @ 23°C, with 1 sample every 5 s on all channels and one minute phone call/day. Refer to “Power Options” later in this section for additional information.
External Battery	For R-3303, R-3307, R-3314, 11.5Vdc to 15 Vdc. For R-3308, 10Vdc to 15Vdc.
External DC, unregulated	15-35 Vdc
Communications	
Type	RS-232 (opto-isolated), standard
Baud rate	300, 1200, 2400, 9600
Connector	9-pin ‘D’ connector, compatible with Telog C-21AT
Modem option	2400-baud plug-in module, FCC and CSA approved
Mechanical & Environmental	
Clock accuracy	± 0.01%
LED indicator	With external power 1 flash every second. On battery power, 1 flash every 5 seconds for R-3308 & R-3314 and 1 flash every second for R-3303 & R-3307.
Operating temperature	-20 to 60°C
Enclosure	Bent aluminum panel mount assembly
Size	for R-3303, R-3307 and R-3308, 21.6 cm x 17.2 cm x 5.7 cm / 8.5” x 6.8” x 2.3” for R-3314, 20.9 cm x 25.2 cm x 5.7 cm / 8.2” x 9.9” x 2.3”
Options	Fiberglass, IEC IP65, NEMA 4X enclosures, contact factory

Table 1-2. R-3308 Analog Inputs

	Measurement Range	Resolution (average)	Accuracy
Ambient temperature* (Telog AT-4 sensor)	0 to 70°C -20°C to 80°C	0.2°C 0.3°C	± 0.4°C ± 0.6°C
RTD** (100ohm Pt, α = 0.00385) Range 1 Range 2	 -220°C to 850°C -220°C to 260°C	 0.4°C 0.15°C	 ± 1.5°C ± 0.6°C
Thermocouple**			
Type K	-80 to 1200°C	0.7°C	± 3.5°C
Type E	-80 to 660°C	0.4°C	± 2°C
Type T	-80 to 350°C	0.3°C	± 2°C
Type J	0 to 750°C	0.5°C	± 3°C
Type R	0 to 1450°C	1°C	± 6°C

* Ambient temperature measurement accuracy does include sensor error for AT-4 sensor.

** RTD and thermocouple measurement accuracy does not include error of sensor.

Analog Channel Inputs

Input Types

The analog channels on the R-3307and the R-3314 have hardware switches you must set to measure either voltage or current, then use Telogers for Windows to select the same input.

Four of the R-3308 analog channels can be set for current loop, voltage (with pulsed excitation) or RTD input. An fifth analog channel is dedicated to ambient temperature input.

Voltage

Each voltage input terminal appears as a 1MΩ input to the recorder's ground and allows for differential measurement of voltage between the + and – terminals in the presence of common mode voltage. The maximum common mode voltage that can exist at each input without introducing measurement error is a function of the range and is described in Table 1-3 and shown in Figure 1-1.

Table 1-3. R-3000 Analog Voltage Inputs

Selected input range	Maximum common mode range
1V or less	± 4V
2V or more	± 40V

Current loop

Current measurement is performed by measuring the voltage across an internal shunt resistor between the + and – input terminals. This resistance produces a burden voltage to the current loop as described in Table 1-4.

The shunt resistance is comprised of a series precision resistor and a positive temperature coefficient (PTC) resistor. If the input current exceeds 80mA, the PTC resistor will increase resistance rapidly to protect the precision resistor. When external excitation is removed, the PTC resistor returns to its original resistance value. When in current mode, the maximum voltage that can be applied across the input terminals without causing damage to the precision shunt is 30V. Refer to Figure 1-2 for schematics.

Table 1-4. R-3000 Analog Current Inputs

Recorder type	Shunt resistance	Maximum burden voltage	
		1 mA range	20 mA range
R-3307, R-3314	200ohms	0.2V	4V
R-3308	100ohms	0.1V	2V

RTD

The R-3308 recorder supports 3-wire and 4-wire 100Ω platinum RTDs with α= 0.00385. Three-wire RTDs require the addition of a jumper between the excitation and + terminals. The recorder automatically performs pulsed excitation, lead-wire resistance correction and linearization for RTD inputs. Refer to Figure 1-3 for schematics.

Thermocouple

The R-3308 recorder supports five types of thermocouples: J, K, T, E and R. Thermocouple inputs are polarized. The recorder automatically performs cold-junction compensation and linearization for thermocouple inputs. Refer to Figure 1-4 for a schematic.

Ambient Temperature

The R-3308 recorder can measure ambient temperature (-20 to +80°C) on channels 1–5 with the Telog ambient temperature probe (AT-4). Channel 5 is dedicated to this measurement. Refer to Figure 1-5 for schematics.

Excitation

The R-3308 analog channels provide pulsed excitation to power external sensors and transmitters on all channels. Pulsed excitation permits the recorder to excite or power certain external sensors and transmitters to minimize power consumption, specifically when the sensor and recorder are powered by batteries. For example, a 4-20mA transmitter, which may consume as much as 240mW if continuously powered, may consume, on average, only 240µW (1000 times less) if the measurement can be taken once every 10sec with an excitation period of 10ms.

If external power is available to the recorder and sensor, it is not necessary to use the pulse excitation feature. (Standard connection diagrams, when excitation is not employed, are provided in Figures 1-1 and 1-2.)

The excitation is user-selectable as 5V, 12V, or 1ma with a programmable duration from 5 to 400ms. The maximum current for 5V and 12V excitation is 20mA. The maximum output voltage for 1ma excitation is 1V.

Some applications using pulsed voltage excitation are described in the list below. The recommended connections for each application are shown in illustrations in Figure 1-6.

- A 2-wire current loop transmitter. Note that a 12V excitation pulse provided to a remote current loop transmitter results in only 10V available for the transmitter since as much as 2V will be dropped across the R-3308 current shunt resistance.
- A 3-wire voltage sensor/transmitter where the signal return is also the negative supply of the sensor. You must supply a connection between the recorder terminal and the ground terminal.
- A resistance bridge network in the range of 250 to 50,000 ohms.
- A 4-wire voltage sensor/transmitter where the output signal is independent of the negative supply to the sensor.
- A 3-wire potentiometer in the resistance range of 250 to 50,000 ohms with 5V excitation. We recommend 5V excitation. The system determines the wiper position as a percent of full-scale travel.

For proper measurement when using the pulse excitation feature, select an appropriate excitation pulse duration. The R-3308 supports sensors that respond rapidly to applied external power and achieve a stable output within 400msec, the maximum excitation period. Some sensors, for example, the Druck PTX 1830 Pressure Transmitters, produce the specified accuracy in 10msec. However, some transducers require in excess of one second to achieve a stable output level, and hence, cannot be used with the R-3308.

If you are not certain the sensor you want to use can be supported by the R-3308 pulse excitation feature, use one of the following three methods:

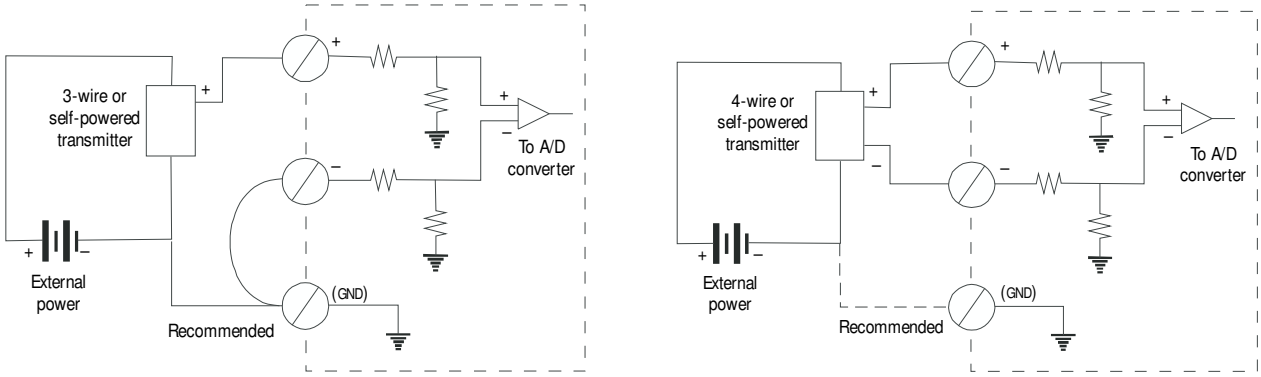
- Refer to the sensor manufacturer's information or contact the manufacturer. (The excitation period typically is not a standard sensor specification.)
- Contact Telog's Customer Service Department for information on known compatible sensors.
- Perform the simple calibration test described below.

Procedure to perform a calibration test

1. Connect the sensor to an appropriate calibrator input and to the R-3308 analog input channel.
2. Provide the sensor with a continuous source of external power (5V, 12V, or 1ma).
3. Document the calibrated output signal level on the R-3308.
4. Replace the external power source with the R-3308 excitation source programmed for 400 msec pulse duration at 10 sec intervals.
5. Repeat step 4 using progressively shorter pulse duration values until you detect a departure from calibration.
6. Select the shortest pulse interval that produces reliably stable calibrated measured values.
7. Repeat this calibration test (steps 1 — 6) at multiple points over the amplitude range to ensure that the sensor responds correctly independent of input signal level.

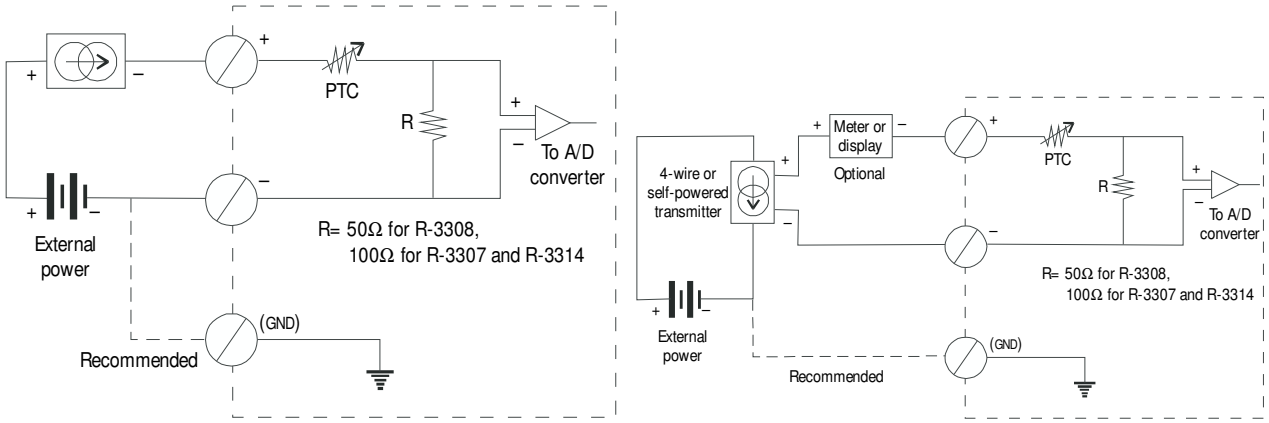
Schematics

This section contains analog channel schematics.



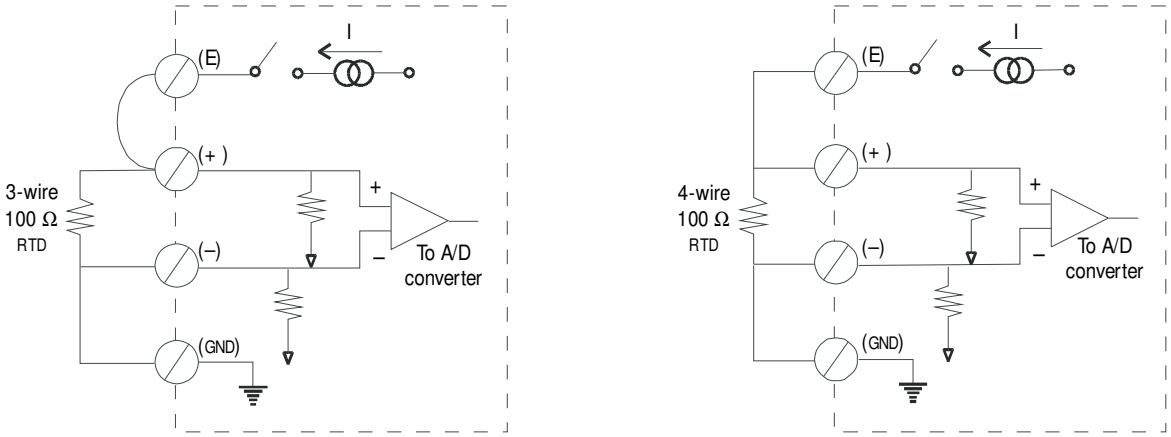
Three-wire voltage transmitter *Four-wire voltage transmitter*

Figure 1-1. R-3000 Voltage channel schematics



Two-wire current loop transmitter *Four-wire current loop transmitter*

Figure 1-2. R-3000 Current transmitter schematics



Three-wire *Four-wire*

Figure 1-3. R-3308 RTD input schematics

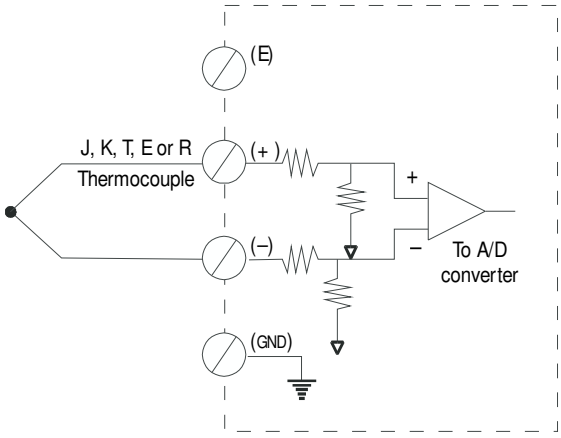
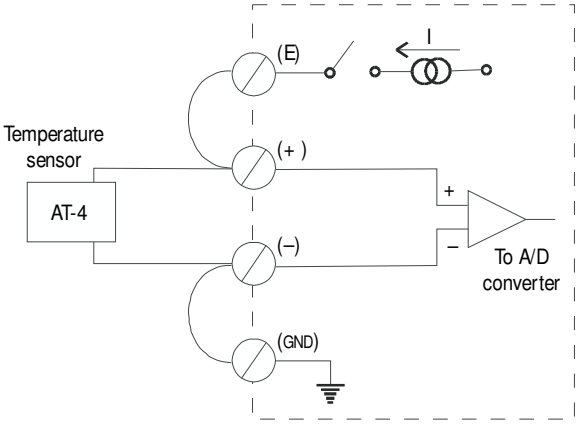
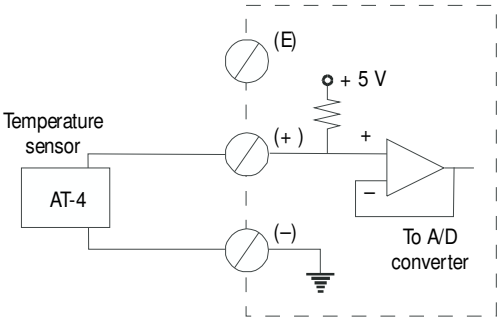


Figure 1-4. R-3308 Thermocouple input schematic

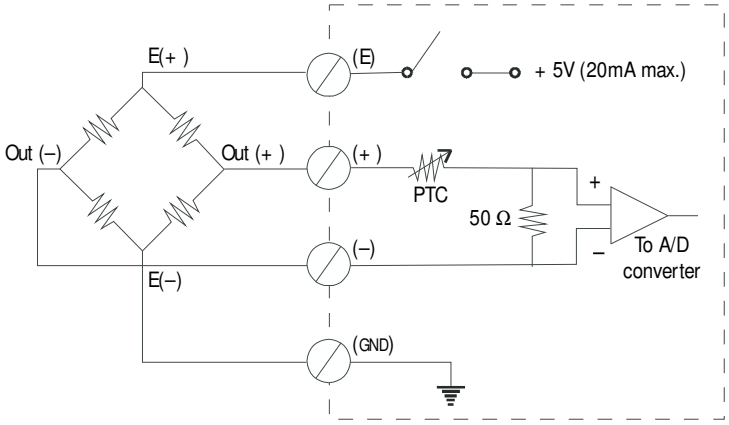


For Channels 1-4

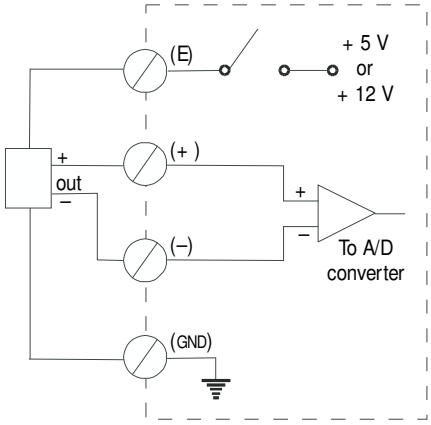


For Channel 5

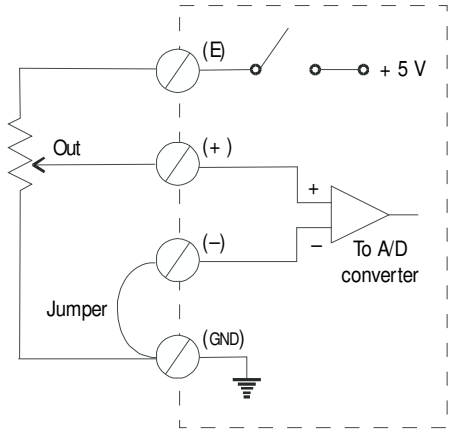
Figure 1-5. R-3308 Ambient temperature input schematics



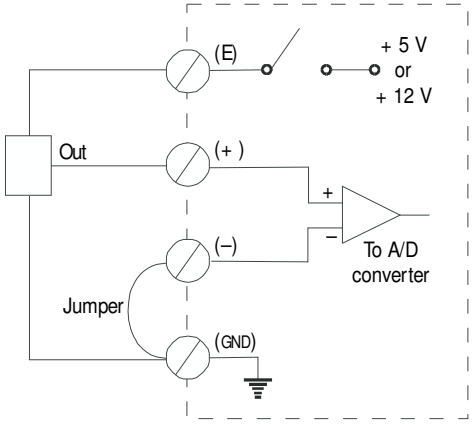
Four-wire resistance bridge



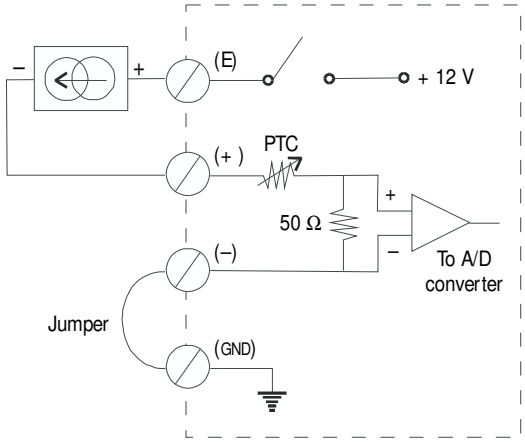
Four-wire voltage transmitter



Three-wire potentiometer



Three-wire voltage transmitter



Two-wire 4-20ma current loop transmitter

Figure 1-6. R-3308 Pulsed excitation applications

Digital Channel Inputs

Summary

The R-3303, R-3307 and R-3308 each have three digital channels and the R-3314 recorder has six digital channels for pulse or event recording. Refer to Table 1-1 for additional information.

Pulse

The pulse input mode is useful for counting the number of pulse events that occur during sequential intervals. For example, it can count the number of times a tipping bucket rain gage tips per hour or the blade rotations of a turbine meter per minute. Each pulse event can be scaled into the appropriate engineering units of measure. Hence, you can converts tips of the bucket rain gage into inches of rainfall per tip, and more appropriately, inches of rainfall per hour. The rotations per minute of a turbine meter can be converted to a flow rate, such as gallons per hour (gph).

The digital inputs may interface either uncommitted mechanical contacts such as switches or relay contacts, actively driven logic or transistor inputs, as shown in Figure 1-7. When interfacing mechanical contact inputs, select the low-speed pulse input, which employs a 3msec contact bounce filter, to eliminate false counting of contact switch bounce. The high-speed pulse selection does not employ an input filter; use it when monitoring high rate events such as turbine meters or radiation counters.

Event

The event input mode records the date and time, to one-second resolution, of a contact closure and/or opening, or the positive and/or negative transition of an analog logic signal. This is useful for recording pump and motor run-time or logging the time-stamp of critical events. For additional information refer “Installation considerations”.

Installation considerations

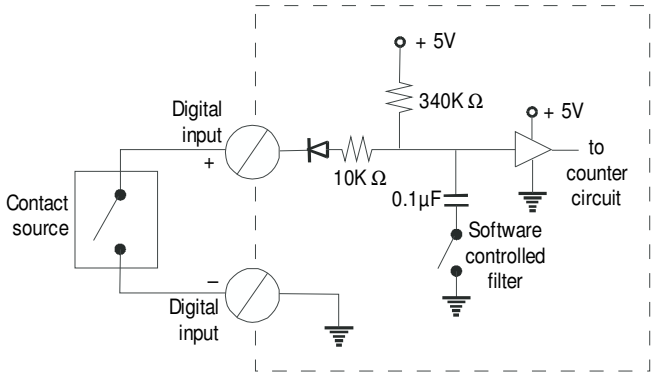
Generally, sensors or systems that produce actively-driven digital output signals have low impedance outputs and are less susceptible to electromagnetic interference than uncommitted contacts or open-collector transistor circuits which use passive pull-up resistors. As a general rule, actively-driven logic signals can be satisfactorily interfaced at cable lengths of 2000ft (600m) while uncommitted contacts (or open-collector transistor circuits) should be less than 100ft (30m).

The pulse/event input circuit employs a high impedance pull-up resistor (350K ohms) to +5VDC to detect contact closures to ground. In applications where the environment is electrically noisy or where the input cable distance exceeds 100ft (30m), add an external resistor and capacitor network with external DC excitation as illustrated in Figure 1-7 to improve the signal integrity. The external excitation may be the recorder’s external power supply input or any DC voltage greater than 5VDC up to a maximum of 30VDC.

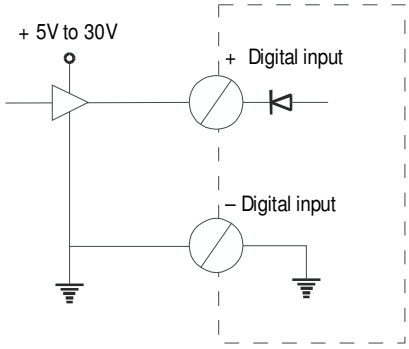
When interfacing active logic inputs (shown in Figure 1-7) select the high-speed pulse input to count pulses as short as 50µsec or frequencies as high as 20KHz. Very short pulses must have high and low periods of at least 25µsec to be detected. The recorder’s detection threshold for the pulse/event inputs is 2.5VDC ± 1VDC.

Schematics

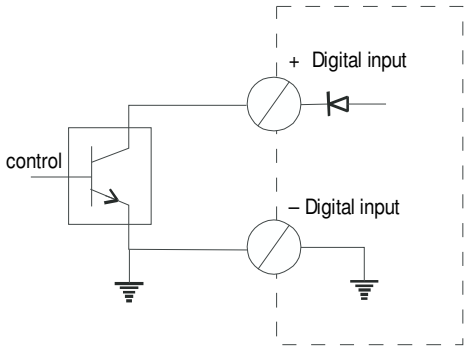
This section contains digital channel schematics.



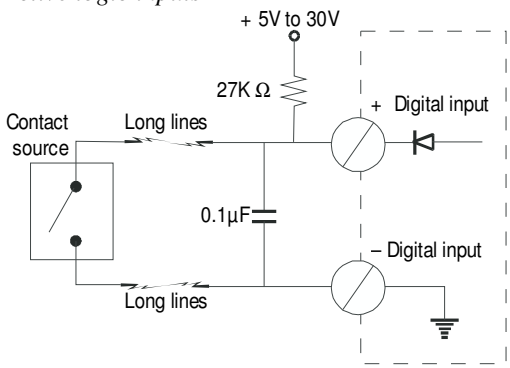
Digital input circuit with contact input



Active logic inputs



Open collector transistor input



Low impedance setup with external resistor and capacitor

Figure 1-7. R-3000 Digital input circuits

Data Collection

Since each channel has separate signal inputs, you can program parameters including channel information, recording and alarm parameters, phone settings and security options for each channel independently using Telogers for Windows. After downloading the channel parameters to the recorder, data collection begins using these parameters.

After recorder installation, each active channel samples its input signal at the programmed sample rate. At the end of a sampling interval, the recorder:

- fetches a reading from each active channel.
- for each analog channel, compares the current reading with the highest and lowest readings that have occurred for that recording interval. If a new minimum or maximum value occurred, the recorder discards the old value and stores the new value in an intermediate buffer.
- adds the reading to an intermediate summation register.

If programmed, at the end of each recording interval, the recorder:

- determines the minimum and/or maximum values for each channel and stores them.
- for each analog channel, computes the average (intermediate summation register / number of samples taken during the recording interval), rounds the value, and stores it. (Inputs on pulse channels are not averaged.)
- updates the totalizer register (channel average *x* number of seconds in the interval) and stores the value.
- clears the intermediate summation register.

At midnight (standard time) the recorder stores a snapshot of the current totalizer value in memory. The recorder maintains a buffer of the most recent 40 days of totalizers for each totalizing channel. The contents of the totalizing buffer is transferred to your computer during routine data transfer.

The time stamps reported for each recorded interval correspond to the start time of a recording interval. For example for a 15 minute recording interval, data reported at 12:00 am was obtained between midnight and 12:14:59 am.

Power Options

Summary

Each Teloger recorder has three power inputs: local battery, external battery and external unregulated DC. Each input is described in Table 1-5 and represented in the schematic in Figure 1-8.

Table 1-5. R-3000 Summary of Power Inputs

Power Source / Input	**Applications**	**Notes**
Local battery	External power is not available at the monitoring site. (In typical applications local battery can power recorder and modem for six months. For the R-3308, pulse excitation can occur.) External power to recorder fails.	Lithium battery pack shipped with recorder (10V for R3303, R3307 and R-3314 and 9V for R3308). Operating temperature: -40° to 70°C. Shelf life is greater than 8 years, but replacement recommended at five years, or more frequently, if primary power source. Refer to Tables 1-6 and 1-7 for battery life calculations.
External battery	12V battery. Solar panel rechargeable battery system. Regulated DC power supply.	Battery voltage range for R-3303, R-3307, R-3314 should be 11.5 to 15VDC. If voltage drops below 11VDC, local battery becomes power source. Input voltage range for R-3308 should be 10 to 15VDC. If voltage drops below 9.5VDC, local battery becomes power source. Input voltages above 16VDC may damage this power input circuit.
Unregulated dc input (15 to 35 VDC)	24VDC power supplies. Unregulated AC to DC converters. Any DC power source with a range of 15-35VDC.	Power sources connected to this input are conditioned by a voltage regulator that consumes 5ma continuous current for R-3303, R-3307, R-3314 (2ma for R-3308). If input voltage drops below 15VDC, external battery, if provided, then local battery, will become power source. Voltages above 36VDC may damage this power input circuit.

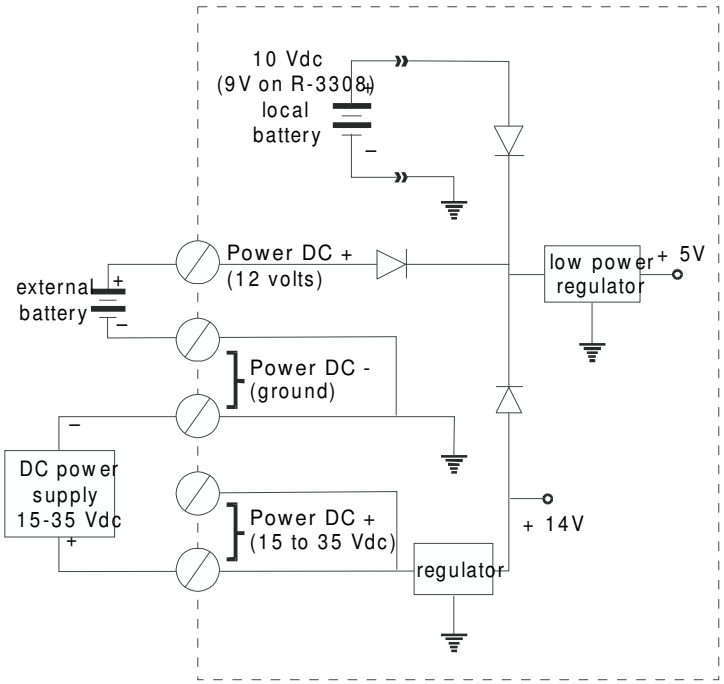


Figure 1-8. R-3000 External power inputs

Battery Life Considerations

Since user applications vary widely and each may place a different set of demands on the recorder's power requirements, it is not possible to provide a single value for the battery life expectation. However, for long-term battery-powered monitoring applications, you should determine, in advance, the battery requirement needs. In general, the factors affecting the rate of battery consumption are:

- Sampling current. The frequency of sampling and current consumed when performing measurements or computations.
- Communications current. The current consumed when the modem is communicating with the host computer by phone (land-line or cellular).
- Excitation current (R-3308 only). The current required to produce the pulsed excitation power for remote sensors and transmitters.
- Background current. The continuous current consumed by the recorder when not performing the above tasks.

The supplied local battery will power the recorder for six months when sampling occurs at 5 second intervals and calling occurs once per week for 5 minutes. A faster sampling rate, more frequent phone calls, or exciting external sensors (R-3308 only) will shorten the battery life.

Computing the battery life, or power requirements, for different applications with the R-3303, R-3307 and R-3314 recorders is described in the next topic. For additional information regarding a specific application, contact Telog Customer Service.

Computing battery life for the R-3308 is substantially more complex than that for other R-3000 series recorders because of the programmable excitation feature and, therefore, it is not provided here. At the time this User Guide went to press, Telog was developing a software utility program that will allow you enter a set of recorder parameters and obtain the battery life, or power requirements, for an operating period. This utility will be posted on Telog's web site (www.telog.com) as soon as it is available. In the meantime, please contact Telog Customer Service for specific questions related to this issue.

Procedure to compute battery life

This procedure computes the battery life for your recorder (R3303, R-3307 or R-3314) based on its current configuration. The local battery life is its power capacity divided by the power demands placed on the recorder.

$$Battery\ Life = \frac{power\ capacity}{power\ used\ (sampling + communications + background\ \ functions)\ /\ month}$$

The example used in this section calculates the battery life for an R-3307. This recorder records on two channels set for 5-second sampling intervals and store three statistics per 15-minute recording interval. The recorder is programmed to call once a week to transfer data. Table 1-6 describes each step of this computation and Table 1-7 shows the actual calculation of battery life for this example. At the end of Table 1-7, we find the recommended time for a battery check and/or change would be nine months.

Table 1-6. Computation of battery life

Step	Resulting parameter	Recorder setting / Value	Multiplier or addition	Notes
1	A power used for sampling each month (mAh/month)	# of samples/minute (value entered in Telogers for Windows)	x *sampling power/month per sample/min factor*	The more frequently data samples are collected, the higher the value of A. Factor is: For R-3303, use 2.2; For R-3307, use 3.7; For R-3314, use 12.4.)
2	B (# of data values)	# of statistical values stored	x recording interval/hr x # channels x # of days between calls	As an example, an R-3307 is using two channels set to sample at 5 second intervals and store three statistics per 15-minute recording interval. This produces 3 values/rec int x 4 rec int/ hr x 2 channels, or 24 values/hr. If the recorder is programmed to call once a week, the amount of data to be transferred is computed using 24 values/hr x 24 hr/day x 7 day/wk, or 4032 values.
3	C estimated call duration (seconds)	B	x 2.1 bytes ÷ (baud rate/10) + 45 seconds	Call duration includes time to establish a comm. session (45 seconds is the average time required for telephone switching and computer log-in) and time for data transfer. Although different types of data take up different amounts of byte space, we use a conservative estimate that each value takes up 2.10 bytes. Actual time for data transfer is obtained by dividing the baud rate (in bytes/second) by the amount of data to be transferred (in bytes). Although a baud is a bit/second or 1/8 byte/second, we use a value of 10 to allow for the start and stop bits that get added to each value transferred.
4	D total monthly call time (minutes/month)	# of calls/month (use values entered in Telogers for Windows)	x estimated call duration (in minutes)	The more frequent the recorder calls, the higher the value of D.
5	E power used for calling each month (mAh/month)	D	x *recorder communications power usage factor*	Power usage factors are: For R-3308, use 0.75: For R-3307, use 0.833; For R-3314, use 1.17.
6	F total battery power used each month (mAh/month)	A + E	+ 100 mAh/month (background power consumption)	This is the sum of the main power usage: power used for sampling each month (A), used for calling out each month and used for background tasks.
7	G calculated battery life (months)	1800 mAh	÷ F	1800Ah is the power capacity of the battery pack used in R-3303, R-3307 and R-3314.
8	Battery Life (months)	G	x 80% (safety factor)	For a conservative estimate, use the safety factor.

Table 1-7. Example computation of battery life

Step	Calculations	Calculated parameter
1	12 samples/min x 3.7 samples/min/mAh/month	= 44.5 mAh/month (A)
2	3 statistics x 4 rec interval/hr x 2 channels x 24 hours/day x 7 days	= 4032 values/call
3	[(4032 values x 2.1) ÷ (2400 baud/10)] +45 sec	= 80.28 sec or 1.34 min
4	4 calls/month x 1.34 min/call	= 5.35 min/month (C)
5	C x 0.833 mAh/min	= 4.46 mAh/month (D)
6	A + D +100 mAh/month	= 148.96 mAh/month (E)
7	1800 mAh ÷ E	= 12.08 months (F)
8	F x 80%	= 9.66 months

Alarms

Four local alarms are available on the R-3308 and R-3314 recorders and two are available on the R-3303 and R-3307 recorders. The Telogers recorder alarm connections are a simple FET switch to ground. They will short to ground only when an alarm condition occurs.

Set the alarm conditions using Telogers for Windows. Alarm connections can trip a relay, sound an alarm, or provide an input to external logic. Figures 1-9 and 1-10 show the alarm connections.

If the recorder detects an alarm condition, the corresponding alarm switch (identified in Table 1-8) closes. The alarm switch will return to its normal open state when all channels have cleared that alarm condition.

Pulse channels on R-3308 recorders can monitor pulse count alarms. If an alarm condition occurs, the alarm switch closes at the end of a recording interval, not during the interval. The alarm switch will return to its normal open state at the end of the next interval when all channels have cleared that alarm condition.

Table 1-8. R-3000 Alarm Switch Assignments

Alarm Condition	Corresponding switch	
	R-3303 & R-3307	**R-3308 & R-3314**
LoLo alarm	—	Alarm 1
Lo alarm	Alarm 1	Alarm 2
Hi alarm	Alarm 2	Alarm 3
HiHi alarm	—	Alarm 4

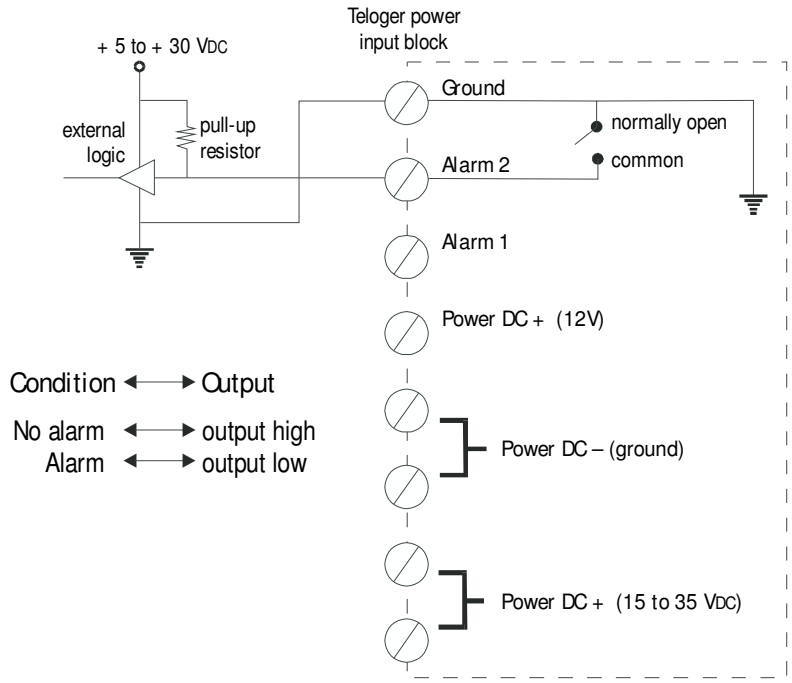


Figure 1-9. R-3000 Voltage signal alarm connection diagram

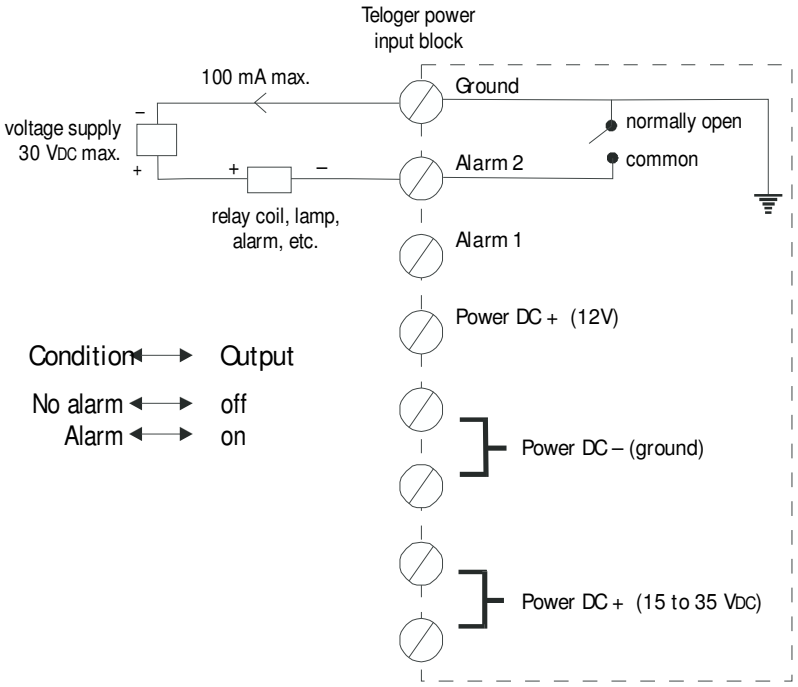


Figure 1-10. R-3000 Relay control connection diagram

Modem Module

The M-324 Teloger modem module is designed to provide remote access to Telog's R-3000 series recorders using a computer running the Telogers for Windows software. The M-324 derives all required signals, including power, from the R-3000 recorder in which it is installed.

Procedure to install the modem

1. Use Telogers for Windows to enter modem information (Setup | Options | Communications.
2. Align the M-324 Telog modem with the 14-pin connector and the raised threaded shaft in the "Auxiliary Module Connection" area on your R-3000.
3. Gently, press the M-324 onto the connector until it sits flush with the surface of your recorder. Do not force the module. It should seat with little effort. If you experience any difficulty, straighten any misaligned pins, carefully realign the module, and try again.
4. Tighten the thumb screw on the M-324 only hand-snug. Over tightening can damage the module.
5. Plug the telephone line's RJ11/CA11 connector into the recorder's phone jack.
6. Check the modem installation by pressing the Tamper button on the recorder for at least one second. If configured in Telogers for Windows, the recorder places a call to the phone number you set for tampering. Refer to the Telogers for Windows User Guide for information on triggers.

General U.S. FCC information

The M-324 Teloger modem complies with Part 68 of the Federal Communications Commission (FCC) rules. On the side of the Teloger modem is a label that contains, among other information, the FCC registration number and Ringer Equivalency Number (REN) for the modem.

The FCC of the United States restricts specific uses of modems. The FCC places the registration responsibilities described below on both the manufacturer and the individual user.

The modem may not be connected to a party line or to a coin-operated telephone. Connection to a party line service is subject to state tariffs. Please contact your state public utility commission, public service commission or corporation commission for information.

The modem manufacturer must make any repairs to the modem to maintain valid FCC registration. If you experience trouble with the M-324 Teloger modem, please contact Telog Customer Service Department at 716-742-3000 for repair and/or warranty information.

If the trouble is causing harm to the telephone network, the telephone company may request you remove the M-324 Teloger modem from the network until the problem is resolved. The telephone company will notify you in advance of any such needed temporary discontinuance of service. However, if advance notice is not practical, the telephone company will notify you as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

Notification to the telephone company is no longer required prior to connecting registered equipment. However, the telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the Teloger modem. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications to maintain uninterrupted service. Upon request from the telephone company, the user shall tell the telephone company to which line the M-324 Teloger modem is connected, as well as the registration number and ringer equivalence number of the M-324 Teloger modem.

Note: The REN is used to determine the number of devices which may be connected to the telephone line. Excessive RENs on the telephone line may result in the connected devices not ringing in response to an incoming call. In most, but not all areas, the sum of the RENs should not exceed five. To be certain of the number of devices that may be connected to the line, as determined by the total RENs, please contact the telephone company for the maximum REN for your calling area.

Please do not attempt to perform any repairs without authorization from Telog Customer Service Department at 716-742-3000.

Canada Department of Communications Notice

The Canadian Department of Communications label identifies certified equipment. This certification means that the labeled equipment meets certain telecommunications network protective operational and safety requirements. The Department does not guarantee the certified equipment will operate to your satisfaction.

Before installing an M-324 Teloger modem, you should make sure that your local telecommunications company will permit connection of the Teloger modem to their facilities. The Teloger modem must also be installed using an acceptable method of connection. In some cases, inside telephone wiring associated with a single-line individual service may be extended by means of a certified connector assembly (for example, telephone extension cord). However, you should be aware that even an acceptable method of connection may not prevent degradation of telecommunications service in some situations.

The load number of the Teloger modem will help determine if your telephone loop will be overloaded. Any combination of devices can be connected to a telephone loop as long as the total load number from all the connected devices does not exceed 100. The load number of a device shows the percentage of the total load of the telephone loop the device will use when it is connected.

For your safety and protection, you should make sure that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Connections should be completed by the appropriate electric inspection authority or an electrician.

Repairs to your Teloger modem should be made by Telog or an authorized Canadian maintenance facility designated by Telog. Please call Telog's Customer Service Department at 716-742-3000 for more information. Any equipment malfunction or repairs or alterations made by the user may give the telecommunications company cause to ask you to disconnect the Teloger modem from their service.

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