



WATCHDOG Tracker
CP Test Station Monitor & Data Logger
Critical Bond Monitor

Installation and Product Specification Manual

Test Station/Critical Bond Monitor Systems

Part Numbers:

TR-N1 (CDMA 1xRTT cellular version)

TR-N3 (GSM HSPA+ cellular version)

TR-S3 (Inmarsat IDP satellite version)

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Installation Manual and Setup Guide

1 Introduction:

This manual includes instructions and specifications pertaining to the following test station and bond applications for Tracker devices using cellular or satellite communication:

Test Station Monitor Applications:

Simple “structure to reference cell” test points
Single, dual, or triple coupon test stations
Generate alarm notifications from out of range readings

AC Monitor Applications:

Measure induced AC voltage on the structure
Measure AC current density at a calibrated coupon
Measure AC drain to ground from an electrical decoupling device (CT coil needed and not supplied by Elecsys)
Generate alarm notifications from out of range readings

Critical Bond Applications:

Measure bond current value and polarity
Measure structure to reference cell for both pipes
Generate alarm notifications from out of range readings



The Tracker Monitor is designed to measure, monitor, and report the values typically measured at CP test stations and critical bond sites. Monitored data is compared to programmable alarm limits for exception alarm reporting, then transmitted to the Pipeline Watchdog Web Monitor database for viewing and reporting.

The Pipeline Watchdog Web Monitor allows the user to: 1) set-up e-mail and text message alarms, 2) set up regular emailed CP rectifier and test station data reports, 3) obtain on-demand data reports, 4) change alarm limit parameters, reporting frequency and monitoring frequency over the air, 5) obtain any/all stored measurements from the unit memory over the air.

The Tracker is designed for simple installation and operation using the color-coded wire harness and built-in mounting tabs. The device easily mounts on a riser pipe, post, or utility pole; and the wire harness accommodates connections to all common test station terminal blocks and bond junction boxes.

2 Tracker Standard Parts Reference Guide:

Prior to installation, familiarize yourself with the system parts and components included with the unit. The Tracker includes the monitor unit, 2 mounting brackets, attachment hardware for the mounting brackets, a connection cable to connect with the measurement points, and 2 ring clamps for mounting to a 3” PVC riser. If the unit is equipped for satellite operation, it is supplied with the combined connection/satellite terminal cable, as well as the terminal, terminal bracket, and attachment hardware.

<p>Tracker Monitor Unit (self-contained, battery operated, cellular or satellite), with 7' (2.1m) 7-conductor measurement connection cable. All connection wires are insulated.</p>	
<p>Satellite Terminal (supplied with satellite units only) Terminal Mounting Bracket and Fasteners</p>	

The following setup guide provides step by step instructions for installation, configuration, and use of the Watchdog Tracker monitor devices.

3 Installation:

3.1 Website Setup and Configuration:

Verify "Site" and "Unit" on the Pipeline Watchdog website (<https://secure.pipelinewatchdog.com>)

1. Prior to field installation log into the Pipeline Watchdog website. A "default" site for the Tracker unit is created at the factory prior to shipment. Locate the default site by doing a "Search" in the "My Network" section of the website. Select "Unit Serial Number" in the "Search By" drop-down box, and input the serial number of the unit (located on the label on the back of the unit), and click the "Search" button on the screen to go to the unit.

2. If unable to locate the Site and Unit using the search tool on the website, contact our **Technical Support Department: (913) 825-6366** (services@pipelinewatchdog.com) and they will assist you in setting up the unit on the website. Technical support can also assist with logon problems, password reset, and any other website issues.

3. **Prior to doing the field installation**, select the proper unit configuration to be sent to the unit upon activation in the field. There are 2 standard configurations for the Tracker, "Test Station" mode, and "Critical Bond" mode. Each mode has several options.

Unit Configuration

To configure the device, go to the "Site Page" for the unit on the Pipeline Watchdog web monitor (log in to Pipeline Watchdog → find site on the Group Page → Click on the site), and click on "Configure Unit" on the right side of the page. From the configure unit page, click on the "Configure Tracker" tool button and the configuration screen will appear. Select the configuration type matching your field application (Figure 1):

Configuration Settings

Unit Configuration
Switch Units
Tracker Configuration

Field Application: Triple or Dual Coupon Test Station with AC Current Drain

Enabled	Channel	Title	Units	Low Alarm	High Alarm	Enable Alarms	Settings
<input checked="" type="checkbox"/>	1	DC Pipe to Soil	mV	-2500	-850	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	2	AC Pipe to Soil	VAC	0	15	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	3	Native Potential	mV	-750	-250	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	5	DC Instant Off	mV	-2500	-850	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	6	AC Current Density	A/m ²	0	50	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	7	DC Current Density	mA/ft ²	0	30	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	8	AC Drain Current	A	0	15	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	13	Calculated AC Density	A/m ²				
<input checked="" type="checkbox"/>		Temperature	°F				
<input checked="" type="checkbox"/>		RSSI	dB				
<input checked="" type="checkbox"/>		Battery	V				

Send Alarms : ☐ Ignore Alarms ☒ Send Alarms

Sampling (Seconds) : ☐ 15 seconds ☐ 1 minute ☐ 10 minutes ☒ 1 hour ☐ 4 hours ☐ 24 Hours

Reporting (Hours) : ☐ 1 hour ☒ 4 hours ☐ 12 hours ☐ 1 day ☐ 7 days ☐ 15 days ☐ 30 days

100%

Figure 1. Tracker “Field Application” selection screen

Selecting the mode for your application automatically enables the appropriate channels in the device and on the web. For example, selecting “Dual Coupon CP Test Station” mode automatically activates the following channels on the website:

- DC pipe to soil potential
- AC pipe to soil potential
- DC “Instant Off” potential (“disconnected” read from protected coupon)
- Induced AC current density (A/m²)
- DC protection current level
- Native (unprotected) coupon to soil potential

Selecting “Critical Bond (with 2 structure potentials)” activates the following channels:

- Bond current (bi-polar indicating direction of current flow)
- Primary DC pipe to soil potential
- Bonded DC pipe to soil potential

There are 6 default modes from which to choose, plus a “Custom” mode allowing the user to configure their channel selection to a specific unique application. “Step 3” on page 8 (connecting the unit in the field), covers in detail the inputs used and channels activated for each mode.

Following mode selection, you will set the alarm ranges for the enabled channels and enable or disable alarm notification on the channels (Figure 2):

Select Parameters to Measure, Report, and Log

Enabled	Parameter	High Alarm	Units	Low Alarm	Enable Alarms?
<input checked="" type="checkbox"/>	DC Pipe to Soil	<input type="text" value="-850"/>	mV	<input type="text" value="-2500"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DC Instant Off	<input type="text" value="-850"/>	mV	<input type="text" value="-2500"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	AC Pipe to Soil	<input type="text" value="15"/>	VAC	<input type="text" value="0"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	AC Current Density	<input type="text" value="30"/>	A/m2	<input type="text" value="0"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	DC Corrosion Current	<input type="text" value="100"/>	mA	<input type="text" value="0"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	DC Native Potential	<input type="text" value="-200"/>	mV	<input type="text" value="-750"/>	<input type="checkbox"/>
<input type="checkbox"/>	DC Struct2	<input type="text" value="-850"/>	mV	<input type="text" value="-2500"/>	<input type="checkbox"/>
<input type="checkbox"/>	Shunt	<input type="text" value="5"/>	A	<input type="text" value="-5"/>	<input type="checkbox"/>

Figure 2. Channel enable, and alarm parameter selection screen

The field application selected in the previous section will automatically enable the appropriate channels for your selected application. You can enable or disable channels if necessary by clicking in the “Enable” box for that channel. The default “High Alarm” and “Low Alarm” settings may be changed for your application. Be certain to note the polarity when adjusting these values. The “Parameter” and “Units” columns indicate the labels applied to the parameter and values on the web display and in reports. These labels can be edited in the “Data Labels and Descriptions” page in the configuration section. The “Enable Alarms” check boxes allow you to select what channels will notify in the event of an out of range reading and what channels will ignore out of range readings.

The bottom section of the unit configuration tool allows you to set the data sampling interval, the scheduled reporting frequency, and the alarm reminder frequency for the device (Figure 3). The data sampling time sets the interval at which the device takes readings and stores them to memory. This can be set for every: 15 seconds, 1 minute, 10 minutes, 1 hour, or 4 hours. The default setting is every 4 hours. The reporting schedule sets the interval at which the device will send readings to the website. This interval can be set as frequent as hourly to every 30 days. The default setting is every 14 days. The alarm reminder sets the interval at which the device will re-send an alarm notification if the alarm has not been addressed and the status is unchanged. The default setting is every 5 days. When all parameters are set, clicking the “Send Configuration” button at the bottom of the screen sends the configuration parameters to the unit. The device will download the configuration the next time it contacts the website and send an acknowledgement to the website indicating successful configuration.

Sampling/Logging, and Reporting Time Intervals

Sampling/Logging interval: ☐ 15 seconds ☐ 1 minute ☐ 10 minutes ☐ 1 hour ☒ 4 hours

[This is the period between measurement samples. All selected parameters are measured at each sample interval. Each sample is compared to alarm limits. The unit is in a reduced power mode between samples. Note that battery life is reduced markedly at short sample intervals (e.g. 15 seconds or 1 minute).]

Automatic reporting interval: ☐ hours ☒ days

Alarm reminder interval: ☐ hours ☒ days

Current Configuration Status: New Configuration Queued but Unsent

Figure 3. Sampling and reporting interval selection screen

Note: When a new configuration is sent to the Tracker, the internal data card is erased. You must retrieve any logged data you wish to keep before sending a new configuration.

3.2 Installation/Mounting:

Mounting the Device:

Recommended Installation Tools and Supplies:

Battery powered drill / screwdriver

Wire cutters

Wire stripper

Utility knife

Crimping tool

Multi-meter

Terminals, Spade 18-22AWG - #10 (for connecting wire harness to measurement points)

¼" x2 ½" Lag Screws (if mounting to a 4x4 post, or for satellite terminal mounting)

The Tracker enclosure has an upper and a lower mounting tab for securing the unit to a standard 3" riser pipe. The electronics and the battery pack inside the enclosure are weatherproff, enabling the unit to be mounted to a post, to the side of a junction box, etc. without exposing the electronics to the environment.. The connection cable supplied with the unit is 7' (2.4 meters) in length. Select a mounting location that allows for this cable length to be sufficient for connecting to the desired measurement points.

If the Tracker uses satellite communication, the satellite terminal, mounting bracket, and the necessary hardware to mount the terminal on the bracket are also included. The satellite terminal must be mounted with a clear view of the sky at the direction and angle of elevation for your location as shown in the chart below:

Geographic Area	Compass Direction	Elevation Angle (angle up from horizon)
Northeastern US	175-185° (S)	35-40°
Southeastern US	175-185° (S)	35-40°
Midwest, Central US	175-185° (S)	25-30°
Southwest US, Texas	175-185° (S)	35-40°
Northwest US	175-185° (S)	30-35°
Columbia, South Am.	355-5° (N)	65-70°
Saudi Arabia, UAE	145-155° (SE)	50-60°
South Africa	355-5° (N)	30-35°
Peru	355-5° (N)	60-65°
Chile, Argentina	355-5° (N)	45-55°
Brazil, Argentina	355-5° (N)	55-75°
Europe	140-160° (SE)	15-30°
India	205-220° (SW)	55-65°
Australia	45-65° (E)	20-30°

When the Tracker and the satellite terminal are both properly mounted, connect the terminal to the Tracker by inserting the connector on the end of the cable to the input connector at the base of the satellite terminal. Turn the collar on the connector ¼ turn to secure the connection. Attaching the wire harness to the measurement points and connecting to the Tracker are covered in the next sections.

3.3 Connecting the Tracker Wiring:

Connecting the unit in the field

The Tracker accommodates input connections for several typical test station or critical bond monitoring applications. Below are the standard connection points for each color-coded wire lead in the multi-conductor cable from the monitor unit. Ensure installation is done according to the instructions in this manual and the product is used for the proper application for proper operation. Securely fasten all wire connections using the appropriate cord anchorage. Wiring schematic for the device is on the following page for reference (Figure 6).

Wire Color Connects to:

<i>Brown</i>	<i>Pipe Structure</i>
<i>Yellow</i>	<i>Reference Cell</i>
<i>Green</i>	<i>Protected Coupon*</i>
<i>Blue/Wht</i>	<i>Structure 2 or "Native" Coupon</i>
<i>Purple</i>	<i>AC Coupon**</i>
<i>Wht/Red</i>	<i>CT Coil or Bond Shunt+</i>

Wht/Yellow *CT Coil or Bond Shunt–*
4.5 Scout Wiring Diagram

**If “On Potential” and “Off Potential” is to be measured, the “Protection On/Off” switch in the test station must be set to the “Off” position.*

*** If connecting to a single or dual coupon test station, connect the AC coupon lead to the “Protected” coupon terminal.*

Illustrated wiring diagram is on the following page.

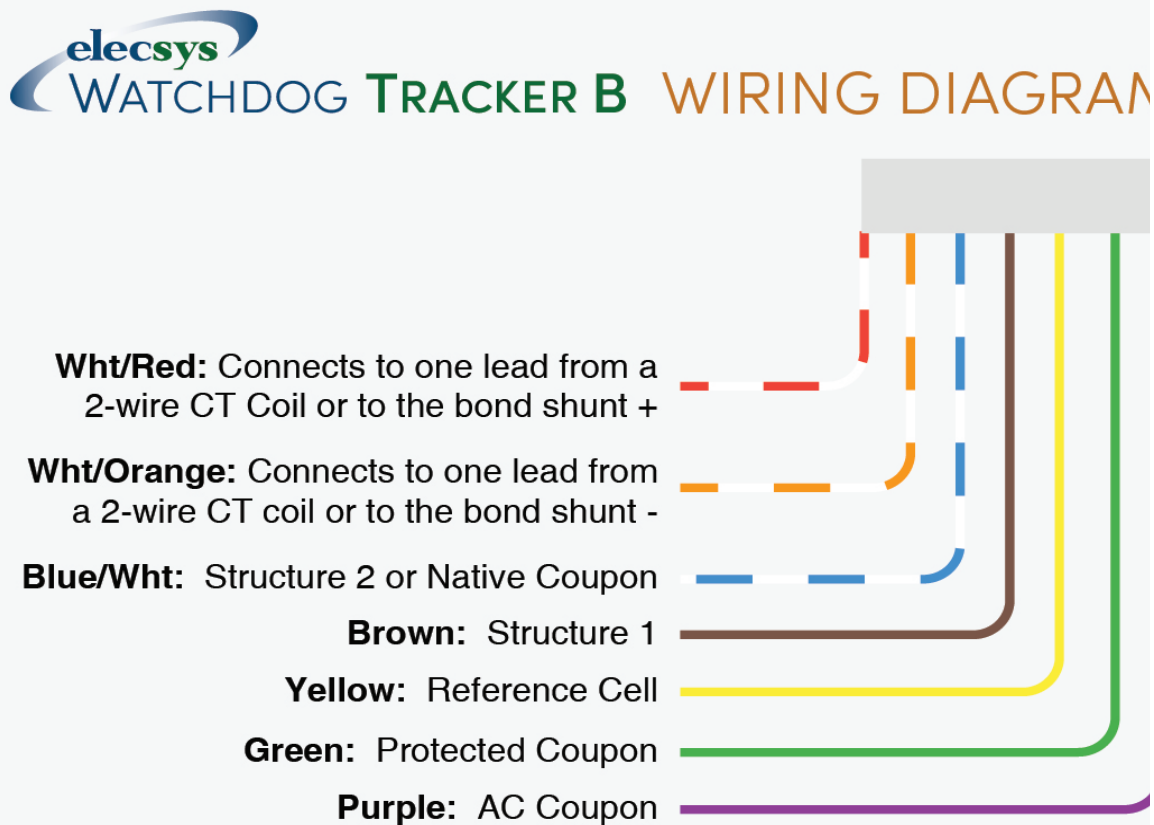
Note: Not all wires are used in all applications. “Tape off” any unused wires to insulate from interference or shorting.

These connection options cover most applications for which the Tracker is designed. If your application includes configuration or connections not covered in these typical setups, please contact our Technical Support Department at (913) 825-6366 and we will be happy to assist you in setup for custom applications.

3.4 Measuring AC Current Drain using a CT Coil:

A “CT coil” current sensor (not supplied) is necessary to measure AC drain to ground. Refer to the “CT Coil Selection Guide” below for recommendations for selecting amp range, etc.

3.5 Wiring Diagram:



This wiring diagram illustrates all available connections to the Tracker B. Not all connections will be used in every installation.

The Pipeline Watchdog web interface has default configurations for:

- Basic Test Station
- Single Coupon Test Station
- Dual Coupon Test Station
- Triple Coupon Test Station
- Critical Bond
- AC Mitigation Test Station
- Custom Settings

If assistance is required to determine the configuration for your application, contact technical support at (913) 825-6366.

Figure 6. Tracker wiring diagram

3.6 Unit Activation:

Activation:

When the unit is installed and connected to the measurement points, it is ready for activation. The Tracker device is battery powered. It comes from the factory ready for activation. To power on the unit and initiate the first communication to the website, press and hold the pushbutton on the side of the unit for 4 seconds until the LED begins flashing. The unit will initialize, establish communication with the cellular system or the satellite system, then retrieve a configuration from the website. When the startup sequence is completed the device will commence taking measurements and reporting to the website as scheduled.

To activate the Tracker and download the configuration selected in Step 1, push the button on the base of the unit and a “Request for Configuration” command will be sent to the website. The configuration will download to the device and an acknowledgement will be transmitted from the unit to the website.

The LED on the front of the unit provides status information during setup and pushbutton communication cycles. The table below indicates the status conveyed through the LED patterns:

State	Communication Status	LED Behavior
Unconfigured	Idle	LED on solid
Configured	Idle	Signal strength (1 to 4 quick blinks every 3 seconds)
Transmitting/Receiving	“Configuration Request” packet sent, awaiting acknowledgement	ON one second, OFF one second
Transmitting/Receiving	“ACK” (Acknowledgement received or Configuration received. Unit operating normally)	Signal strength (# of flashes = “bars”)
Transmitting/Receiving	Communications timeout	Rapid, continuous blinks
Transmitting/Receiving	“NACK” (Communication established, but no acknowledgement received, website setup problem)	LED on solid
Transmitting/Receiving	Insufficient signal strength	Rapid, continuous blinks

When the “status” LED is flashing the communication signal strength (1 to 4 rapid flashes every 3 seconds) communication with the Pipeline Watchdog website is successful. The LED will automatically turn off following a successful transmission. This completes the field installation.

4 Using the Pipeline Watchdog Web Monitor:

Once the Tracker is properly installed in the field, the user's primary contact with the system will come by using the website. All programming for alarm thresholds, reporting frequency, interrupter parameters, etc. is done over the web.

To change any of the parameters in the configuration at any time, go to the "Configure Unit" selection page for that site on the Pipeline Watchdog web interface and select the changes desired then click on "Send Configuration" to send the changes. The Tracker will download the new configuration the next time it communicates to the website and a "CONFIG ACK" (configuration acknowledgement) response will be received from the unit to the website indicating the configuration change was successful.

4.1 Using the Data Logger:

The Tracker will automatically log all readings for enabled channels to a 2GB SD memory card in the device. The logged data can then be retrieved by downloading the data to the website. To retrieve logged data over the web click on the "Data Logger" button on the site page of the unit. The following "Data Logger File Retrieval" screen will open (Figure 7):

Data Logger Over-the-Air File Retrieval

Use ☒ Local Time ☐ GMT

Start Date (inclusive): 02/01/2015

Stop Date (inclusive): 02/10/2015

Sample retrieval interval: ☒ 1 hour ☐ 4 hours

Select Channels to Retrieve

Retrieve	Channel
<input checked="" type="checkbox"/>	DC Pipe to Soil
<input checked="" type="checkbox"/>	AC Pipe to Soil
<input checked="" type="checkbox"/>	Native Potential
<input type="checkbox"/>	AC Pipe to Soil 2 (Channel not enabled)
<input checked="" type="checkbox"/>	DC Instant Off
<input checked="" type="checkbox"/>	AC Current Density
<input checked="" type="checkbox"/>	DC Current Density
<input checked="" type="checkbox"/>	AC Drain Current
<input type="checkbox"/>	DC Bond Current (Channel not enabled)

Estimated file size: Estimated telemetry cost: [Calculate File Size and Cost](#)

Upload file to: Production [Send File Request](#)

Figure 7. Data Logger file retrieval screen

The file retrieval screen allows you to select a date range, sample frequency, and the channel(s) from which you want to retrieve data. The sample frequency resolution will not be greater than the sample frequency set in the configuration (i.e. if the unit is sampling once every hour, only those samples are being logged to the card). When the date range, sample frequency, and channels are selected for the download, click on the “Calculate File Size and Cost” button to calculate the cost of the download.

IMPORTANT NOTE! There is an additional communication charge of \$0.10/kilobyte of data downloaded (1kb of data is equivalent to approximately 2 weeks of sampling all measurements at 1 hour intervals).

When the file size and download cost has been calculated, click on “Send File Request” to send the command to the Tracker. The data will be downloaded the next time the unit communicates with the website. The “Data Logger Requests” log at the bottom of the page (Figure 8). The requests log indicates the status of the request (pending or complete). When the request is completed, the file is accessed by clicking on the “Download” link under “Actions” on the right of the screen. The file is opened in an Excel page as a comma separated value (.csv) spreadsheet. The downloaded file can be copied, saved, and exported from the Excel view.

5 Tracker Product Specifications:

Part Number	CDMA cellular telemetry: TR-N1 GSM cellular telemetry: TR-N3 IDP satellite telemetry: TR-S3
Input Connections All connection wires are insulated. Be certain all wire connections are properly secured and fastened with the appropriate cord anchorage.	Structure 1 (pipeline) Structure 2 (second pipeline or “native” coupon) Reference cell “Protected” coupon “AC” coupon (Note: if no dedicated AC coupon is used AC measurements can be taken on the “protected” coupon) Shunt/CT coil + Shunt/CT coil –
Data-logging	Embedded SD - >15 years of samples at 15 second sample rates. (faster rates available with custom configurations) Sample frequency up to every 15 seconds
Power	Li-SOCL2 Lithium battery (3 to 5 year life under normal conditions and operating parameters) (NOTE: the Elecsys P/N: 49-0046-00 battery pack is the only authorized battery replacement!) Connection for external power: 6.5 to 18 VDC (nominally 12V solar). Solar panels or solar power system not supplied by Elecsys Corporation
Operating Environment	Temperature: -40°C to +70° Humidity: 0-95% non-condensing
Enclosure	IP66 rated, 14” (35.5cm) x 3 3/8” (8.6cm) x 3” (7.62cm)

5.1 Measurement Channel Specifications:

Measurement Channel	Channel Range	Accuracy
DC potential (structure 1 to reference)	-10V to +10V	1mV
AC potential (structure 1 to reference)	0 – 35V rms	10mV
DC Potential (structure 2 or native to reference)	-10V to +10V	1mV
AC potential (structure 2 or native to reference)	0 – 35V rms	10mV
Protected coupon “instant off” (coupon to ref.)	-10V to +10V	1mV
AC current density (structure 1 to coupon drain)*	0 – 500 mA rms	0.1mA
DC protection current density (structure 1 to coupon)	-100mA to +100mA	0.1mA
AC drain current (voltage across external CT coil)	0 – 500 mV rms	0.1mV
DC bond shunt current (across external shunt)	-150mV to +150mV	0.1mV

* **Note: the Tracker can simultaneously/alternatively calculate AC current density using the pipeline AC voltage potential measurement and a user supplied soil resistivity measurement value constant.**

6 Accessories:

Description

Part Number

External cellular High-Gain Antenna Kit
(includes: antenna, bracket, and adapter)

48-0003-21

Replacement Battery Pack

49-0046-00

(NOTE: this battery pack is the only authorized battery replacement!)

7 Technical Support:

In the event of a problem, Elecsys always stands ready to provide prompt service and technical support.

Elecsys Technical Support Hours: 8AM to 5PM Central time, Monday through Friday

Elecsys Technical Support Direct Phone: 913-825-6366.

Most support issues are quickly resolved over the phone. If the problem cannot be resolved by phone, Elecsys will arrange for repair or replacement equipment as soon as possible to get the site operational once again.

During the Warranty Period, Elecsys will repair or replace problems systems or components at its expense. After the Warranty Period expires, Elecsys will repair or replace failed components for a fair and reasonable charge.

7.1 Products Under Warranty:

Call Elecsys Technical Support at 913-825-6366.

Upon determination by Elecsys that the problem is related to a cause that is covered under this warranty, instructions for returning the Product will be provided, as well as an RMA number.

A repaired or replacement Product is warranted in accordance with the terms of the standard limited warranty, for the balance of the term applicable to the inoperative Product.

Upon its examination, if the inoperative Product is found to have problems not covered under the warranty, Elecsys reserves the right to charge for repair services.

Replacement parts or Products will be shipped to domestic customers at Elecsys' expense, subject to availability, via ground delivery service and at international customers' expense. Elecsys shall not be responsible for failure of the delivery service to make on-time delivery.

7.2 Products Not Under Warranty:

Call Elecsys Technical Support at 913-825-6366.

Upon determination by Elecsys that the problem is related to a cause that must be remedied by Elecsys, instructions for returning the Product will be provided, as well as an RMA number.

A purchase order or other such authorization will be required to cover the cost of repair or a replacement Product.

A repaired or replacement Product is warranted in accordance with the terms of the standard limited warranty, for a period of 90 days following installation and activation.

8 Warranty Policy:

For a period of eighteen (18) months from the date of shipment, Elecsys warrants that its products will be free from defects in workmanship and materials.

For the same period, Elecsys warrants that its products will perform to their specifications and, to the extent Elecsys is informed of the use(s) for which the original purchase is made, are fit for such use(s). NO OTHER WARRANTY, EXPRESS OR IMPLIED IS MADE OR MAY BE IMPLIED.

Any claim that an Elecsys product is defective shall be made in writing and supported by such detail and/or documentation as Elecsys shall reasonably require.

9 Sales Contact Information:

Please contact Elecsys Remote Monitor Sales at (913) 888-5222 or by email: sales@watchdogcp.com for order and pricing information.

Our Commitment –

The goal of the Remote Monitor division of Elecsys Corporation is to provide you with the best products and service available in the industry. If you encounter any difficulties, or have any questions or concerns, before, during or following installation, please contact our Technical Support Team: (913) 825-6366 or support@watchdogcp.com . We are fully staffed Monday through Friday, from 7:00am Central Time to 5:00pm Central Time and WE ARE HERE TO HELP!

Elecsys Corporation

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