Elecsys ISM-4
Remote Monitoring System

Installation and Product Specification Manual

ISM4-L1 (Modbus)

Elecsys ISM-4 Product Manual and Installation Guide

Contents

Product Manual and Installation Guide

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Simple 2-Channel (Voltage, Current) Rectifier Monitoring (up to 4 channels total)
Rectifier Monitoring with Pipe to Soil Reading
Rectifier Monitoring with up to 2 Additional Current Readings
Detection/Alarm Notification of Rectifier AC Input Power (available in all applications)
Digital “Dry-Contact Switch” Monitoring (Door Alarms, Valve State, etc.)

Thermoelectric Generator (TEG) and Solar Impressed Current System Monitoring
Up to 4 Channels of System Monitoring (Voltage, Current, Potential)
Power status notification of “Power Fail” conditions

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
External power required at site for operation as a slave RTU

1.2 General Introduction

The Elecsys ISM-4 Monitor is designed to measure, monitor, and report DC voltage in the +/-200 volt, +/-10volt, and +/-100 millivolt ranges. The unit is ideal for monitoring values typically measured at cathodic protection rectifier and impressed current generation systems. The Elecsys ISM-4 Monitor enabled with Modbus version firmware operates as a “poll/response” Modbus slave RTU..

The Elecsys ISM-4 is designed for simple installation and operation using the quick-connect wire harness and mounting brackets included with the unit. The device easily mounts at any typical rectifier site and the wire harness accommodates connections to all common rectifier measurement connection points.

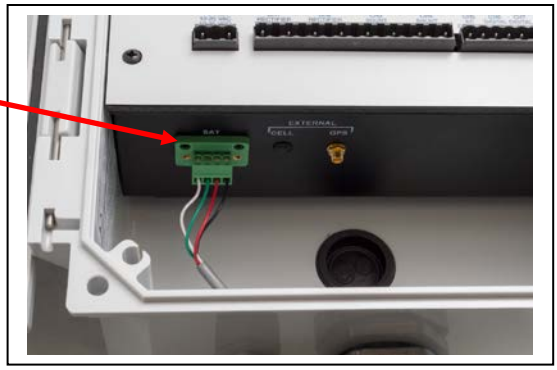
2 Elecsys ISM-4 Standard Parts Reference Guide

Prior to installation, familiarize yourself with the system parts and components included with the unit. The Elecsys ISM-4 includes the monitor unit, AC Probe, 2 mounting brackets, attachment hardware for the mounting brackets, a power cable, serial communication cable, and the input connection cable harness to connect with the measurement points.

Elecsys ISM-4 Monitor Unit – Self-contained 5” x 8” x 3” NEMA 4 enclosure. Operates on low-voltage AC (10VAC to 25VAC), low-voltage DC (10VDC to 35VDC), or field replaceable lithium battery pack (3 to 5 year estimated battery life).	
Mounting Brackets and Hardware 2 durable mounting brackets and attachment hardware necessary to secure the brackets to the ISM-4 device.	
AC Probe Detects AC power present/not present at the main AC power input leads to the rectifier.	

Communication Cable

White - TX
Green - RX
Red - Power
(not used for “slave” operation)
Black - Ground



3 Field Installation Instructions

3.1 Mounting the Device:

The Elecsys ISM-4 easily mounts on a pole or inside a rectifier enclosure. The ISM-4 enclosure is NEMA 4x rated and suitable for mounting inside or outside of a rectifier.

Recommended Installation Tools and Supplies:

- Battery powered drill / screwdriver
- Wire cutters
- Wire stripper
- Utility knife
- Crimping tool
- Multi-meter
- #18-22AWG spade or ring terminals to connect to the rectifier measurement points
- #18-22AWG in-line splices or wire nuts to connect the AC Probe to the wire harness
- ¼" x2 ½" Lag Screws (if mounting to a 4x4 post, or for satellite terminal mounting)

Included with the Elecsys ISM-4 are 2 - mounting brackets (upper and lower), and connection hardware necessary to secure the mounting brackets to the enclosure. Mounting to a utility pole or 4x4 post is accomplished using ¼' wood screws (McMaster-Carr #94048A224) with the supplied mounting brackets. The Elecsys ISM-4 may also be mounted inside a rectifier, or a junction box, using the brackets or the 4 mounting holes molded into the upper and lower enclosure flanges. 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 metal mounting brackets are used in securing the device, attach them to the Elecsys ISM-4 enclosure with the bracket cleats oriented outward.

3.2 Connecting Input Measurement Signals to the unit in the field

The Elecsys ISM-4 Monitor is designed to monitor and report voltage, current, and pipe to soil potential values from impressed current CP systems. The device will measure up to 4 analog channels, and to detect AC input power to the rectifier. It also has a digital channel for dry-contact closure monitoring (tamper alarm, etc.)

Basic Rectifier Monitoring (rectifier output voltage, rectifier current, AC detection, external power input for 2-way operation)

Step 1 – Connect input power

The Elecsys ISM-4 can be powered in 1 of 3 ways:

1. Primary AC using a step-down transformer or AC to DC power supply **(most common, allows full 2-way operation)**
   The Elecsys ISM-4 is designed to operate on low-voltage AC or DC power. Mount the transformer/power supply in a secure, safe location inside the rectifier enclosure. If operating using a step-down transformer, the output voltage should be between 12VAC - 25VAC. If using an AC to DC power supply the voltage will be approximately 15VDC. Connect the red and black wires from the power input cable to the output of the transformer/power supply (if using DC power supply RED- BLACK+).

NOTE: DO NOT CONNECT THE WATCHDOG ISM-4 DIRECTLY TO HIGH VOLTAGE AC POWER AS THAT WILL DAMAGE OR DESTROY THE UNIT!

2. TEG or Solar Generator DC Power (if only DC is available)

At TEG and Solar sites, the input power to the Elecsys ISM-4 will be DC supplied by the generator or storage batteries. Input power in the range of 10VDC to 35VDC is required for operation. To connect the Elecsys ISM-4 system to a DC external power source, connect the red power cable lead to the positive terminal at the power supply and the black lead to the negative terminal. For these applications a DC to DC converter is recommended in order to supply stable, isolated power. Elecsys offers 2 DC to DC power options (listed in the "Parts and Accessories" section).

Step 2 – Terminate the measurement input cable harness leads to the proper points

The factory configuration of the ISM-4 is set to monitor rectifier voltage, rectifier current, and rectifier input power (AC present/not present). If this is the application desired, connect the input cable harness wires as shown below:

Wire Color	Channel	Connects to
Red	Channel 1+	Rectifier voltage output + terminal
Black	Channel 1 -	Rectifier voltage output – terminal
White	Channel 2 +	Positive terminal on the shunt
Green	Channel 2 -	Negative terminal on the shunt
Orange	AC Probe +	"Red" lead from the AC Probe
Blue	AC Probe -	"Black" lead from the AC Probe

If additional channels are needed, the following leads are used:

Wire Color	Channel
Pink	Channel 3 +
Tan	Channel 3 –
Purple	Channel 4 +
Brown	Channel 4 –

Note: If channels 3 and/or 4 are to be used, or if the channel configuration required is different than the factory default settings, the channels will require activation and/or configuration.

Common applications for the additional analog channels:

Pipe to Soil potential readings
Additional "negatives" where multiple pipelines are connected to the rectifier
Critical Bond applications (bond shunt plus multiple potential readings)

Digital, dry-contact monitor channel:

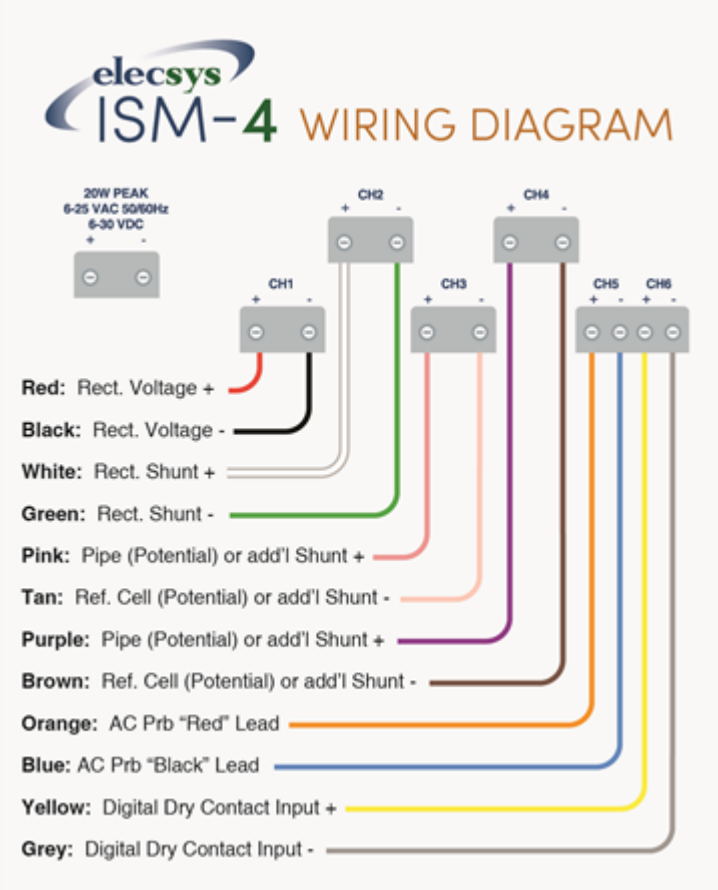
Wire Color	Channel
Yellow	Digital Input +
Grey	Digital Input –

The Digital Channel is activated using the "Digital Channel" option on the "User Menu". Select the "Digital Channel" option from the menu, select "Enable" or "Disable" (factory default is "Disable"), and if enabled select "Normal" as "Open" or "Closed".

If your application requires configuration or connections not covered in the typical setup, please contact our **Technical Support Department at (913) 825-6366** and we will be happy to assist you in setup for custom applications.

NOTE: TRIM AND ISOLATE ANY UNUSED WIRES ON THE WIRE HARNESS TO PREVENT ELECTRICAL SHORTING.

3.3 ISM-4 Wiring Diagram



4 Unit Configuration Settings

4.1 Analog Measurement Channel Ranges

The Elecsys ISM-4 has four analog measurement channels. Each channel can be set to measure in any of four measurement ranges. The table below describes the ranges and the typical application for each:

Measurement Range Menu Description	Voltage Range	Input Impedance	Typical Application
Voltage	+/- 200 Volts DC (+/- 1%)	> 1 meg-ohm	Rectifier Voltage
Current (1)*	+/- 200 mVolts DC (+/- 1%)	> 1 meg-ohm	Rectifier Shunt Current/Bond Shunt Current
Pipe to Soil	+/- 10 Volts DC (+/- 1%)	> 10 meg ohms	Structure to Reference Cell Potential
Current (2)*	+/- 200 mVolts DC (+/- 1%)	> 1 meg-ohm	Rectifier Shunt Current/Bond Shunt Current

**Current (1) and Current (2) both measure in the same (+/- 200 mV) range. Current (1) takes the direct measurement from the shunt and is applicable to most sites. Current (2) uses noise filtering circuitry and is designed for site applications where Current (1) does not produce accurate readings. The recommended best practice is to initially configure current channels to use Current (1) and change to Current (2) only if there are accuracy problems at the site due to interference.*

Elecsys ISM-4 units ship from the factory configured for 2-channel rectifier monitoring (Channel 1 – Voltage, Channel 2 – Current). The instructions for reconfiguring the ISM-4 device are in the next section of this guide (section 5.2 “Configuration and Activation Menus”) and on the “Quick-Start Setup Guide” supplied with the Elecsys ISM-4 unit.

4.2 Configuration and Activation Menus

1. When the Elecsys ISM-4 unit is powered on the device will initialize. The Green LED power light will come on solid and “Elecsys ISM-4 Ver. X.XX” will display in the LCD for 3 seconds, followed by a 10 second communication test.
2. Following the communication test, the device will commence normal operation. The interval to the next query time and report time will display in the LCD. The signal strength will display in the 4 LEDs on the right side of the LCD display. Signal strength is shown by the number of LEDs that are lit, with 1 being the lowest and 4 the highest.
3. The ISM-4 comes configured from the factory for basic, 2-Channel, rectifier monitoring: (Channel 1=Volts, Channel 2=Amps, Channel 3 and 4 not used, and externally powered for always-on, pollable use). If a different configuration is needed, the unit can be reconfigured using the front panel buttons (Up, Down, and Enter) and the LCD display.

4. There are 3 User Menus: “Channel Setup”, “Unit Settings”, and “Diagnostics”. There is an “Exit” option from the main menus selection screen to exit the menus and save changes.
5. The chart below shows the steps required to configure channel activation and settings:

Step	Action	Display
1 - Enter configuration menus	Press & hold both arrow buttons for 3 seconds, release when "Enter User Menu" is displayed	LCD will show "Enter menu in:X" (countdown from 5 to 0), then switch to "Enter User Menu"
2 - Select function	The function to view/change is indicated by an "Arrow" icon on the right of the display. Scroll using the "Up" and "Down" buttons until "Channel Setup" is selected. Press "Enter".	When the "Channel Setup" menu is entered, the option to select channels 1 through 4, and to "Return" to the previous menu, will be displayed.
3 - Select channel to activate/change	Scroll to select the channel to change using the "Up" and "Down" buttons. Press "Enter" to select.	When the desired channel is selected, the display will show: "Use Ch X? Yes/No".
4 - Activate/Deactivate channel	To activate a channel, select "Yes" and press "Enter". To deactivate, select "No" and press "Enter".	If a channel is activated, the display will show the available "Ranges"; Voltage, Current(1), Pipe to Soil, Current(2).
5 - Select channel measurement range	Scroll the selection arrow to the range desired for the channel. Volts=+/-100V, Current(1)=+/-100mV, Pipe to Soil=+/-10V, Current(2)=+/-100mV (high filtering for "noisy" signals).	After the range is selected, the display will return to the "Channel Selection" options. Repeat steps 3, 4, and 5 for any additional channel setup.
6 - Exit menus	In the Channel Menu select “Return” and press “Enter” to reach the main menu. Scroll to exit "Exit” and press "Enter" to exit menus and save changes.	Following exit, “Saving Changes” will display.

4.3 Additional "User Menu" Options

In addition to the Channel Setup menu, Unit Settings menu, and the Diagnostics menu, there are keycode restricted menus for additional settings and troubleshooting functions. These menus can only be accessed and used in consultation with Elecsys Technical Support (913) 825-6366 or support@watchdogcp.com. The Diagnostics menu is "view only" for system information and troubleshooting use. The tables below show the parameters and settings available for viewing and changing in the User Menus:

Channel Setup Menu

Menu	Parameters	Value	Settings	Notes
Channel Setup	Channels 1 through 4 and Return	Use Channel?	Yes/No	Select "Yes" and press Enter for every channel that will be connected to a measurement point
		Select Type (Select the channel type/range for each active channel)	Voltage	Range=+/- 200 Volts (DC)
			Current(1)	Range=+/- 200 mVolts (DC)
			Pipe to Soil	Range=+/- 10 Volts (DC)
			Current(2)	Range=+/- 200 mVolts (DC) (This setting uses increased filtering for high noise electrical environments)

Unit Settings Menu

Menu	Parameters	Value	Settings	Notes
Unit Settings	Modbus Address		1-247	Use this setting to set the address for this unit (1-247). Default value is "1".

Diagnostics Menu

Menu	Parameters	Value	Settings	Notes
Diagnostics	Battery Charge	Battery Voltage		Displays Battery Voltage
	Power Setting	External Power	Displays "External Power - GOOD or FAIL"	
		Battery Powered	Displays "External Power - FAIL"	
	Channel Types	Displays "Active" channels and measurement range setting for each active channel	View Only, No Settings	

Exit Menu

Menu	Parameters	Value	Settings	Notes
Exit		Exits the User Menus section and saves changes	Press “Enter” button to exit the user menus section	Following exit, “Saving Changes” will display. The LCD will resume displaying the “Query Time/Report Time” intervals.

5 Elecsys ISM-4 Product Specifications

Part Number	ISM4-L1
Operating Environment	Temperature: -40□C to +85□C Humidity: 0 - 95% non-condensing Enclosure rating: NEMA-4X polycarbonate
Power	External power for "always on" full 2-way operation: 10-25VAC or 10-35VDC. Internal Li-$SOCL_2$ battery pack; non-rechargeable, for power-fail backup operation 3 - 5 year replacement cycle under normal conditions
Dimensions	5.3" (135 mm) X 7.8" (200 mm) X 2.8" (72 mm)
Installation	Mounting: Universal brackets included for pole, or post mounting. Measurement Input Harness Cable: 7' - 12-conductor cable harness. Power Harness Cable: 7' (2.4m) molded, weatherproof, 2-conductor cable harness.
Input Connections	Channel 1 +/- Channel 2 +/- Channel 3 +/- Channel 4 +/- AC Detect +/- Digital Channel +/-
Measurement Channel Input Ranges	Analog Input Channels (#1 - #4): Voltage Range= +/- 200 Volts DC (+/-1%) 1Mohm input impedance Current Range(1)= +/- 200 mVolts DC (+/-1%) 1Mohm input impedance Pipe to Soil Range= +/- 10 Volts DC (+/-1%) >10Mohm input impedance Current Range(2)= +/- 200 mVolts DC (+/-1%) 1Mohm input impedance Digital Input Channel: Dry contact type
Certifications	UL/CSA 61010-1

6 Modbus Register Map

Elecsys ISM-4 Modbus Register Map

Channel	Register	Data Type
Analog Channel 1	30,001	SINT16
Analog Channel 2	30,002	SINT16
Analog Channel 3	30,003	SINT16
Analog Channel 4	30,004	SINT16
Digital Input	10,001	UINT16
AC Detect Probe	10,051	UINT16
External Power Status	10,052	UINT16
Firmware Version	30,051	UINT16
Battery Voltage (mV)	30,052	UINT16
Unit Temperature	30,053	SINT16
Data Sampling Interval (min.)*	40,101	UINT16
"Sample Now" Command	00,101	UINT16

**** This value must be set to greater than "0" before the unit will acquire data. The available sample interval range value is: 1-65535***

7 Port and Protocol Settings

ISM-4 Configuration Serial Communication Port and Protocol Settings	
Parameter	**Setting/Range**
Serial Interface	RS232
Baud Rates Supported	9600, 19200, 38400, 57600, 115200
Duplex	Half
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None
32 Bit Integers	Big Endian (MSW/LSW)
Slave Address Range	1 thru 247 (Default Setting: 1)
Protocol	Modbus RTU
Addressing Mode	Standard or Extended

Serial to IP Conversion Notes: The Elecsys ISM-4 supports communication using Modbus RTU (binary) serial communication. Connectivity over an IP network is supported directly from host systems using Modbus RTU (encapsulated within IP). For host systems using Open Modbus/TCP, a terminal server with translation capability (such as the Elecsys RediLink) will be necessary in order to provide a properly formatted protocol interface between the Elecsys ISM-4 and the host system.

8 Replacement Parts and Accessories

Description	Part Number
Replacement Power Cable	65-0182-00
Replacement Analog Signal Cable	65-0187-00
Replacement Mounting Bracket (single bracket only)	86-0692-08
$LiSOCL_2$ Battery Pack	49-0028-00
DC to DC Power Converter (9-18VDC Input/15VDC Output)	31-0030-01
DC to DC Power Converter (18-75VDC Input/15VDC Output)	31-0030-02
AC Transformer (120V/240V 50VA 24VAC Output)	46-0185-01

9 Technical Support

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

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

Technical Support Direct Phone: 913-825-6366.

Most support issues are quickly resolved over the phone. If the problem cannot be resolved by phone, NTG 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, we will repair or replace failed components for a fair and reasonable charge.

9.1 Products Under Warranty

Call 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.

9.2 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.

10 Warranty Policy

For a period of fifteen (15) 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.

11 Sales Contact Information

Elecsys Remote Monitor Sales: (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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(913) 888-5222 Main Phone

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