ELTEK
A Delta Group Company

Installation Guide

I/O Monitors

CAN Bus Nodes

Power Supply Systems

Outdoor (T1) and Solar Hybrid Applications (T3)

SAFETY and ENVIRONMENTAL PRECAUTIONS

The **product warranty** becomes invalid if the following safety precautions are not followed during handling, installation, commissioning and general use/operation of *Eltek* power supply systems.

General Precautions

Device Hazard

CAUTION: Even though the product incorporates protection circuitry and other safeguards, it can be **damaged, perform poorly or have a reduced lifetime** if it is exposed to **incorrect treatment** during transport, installation or service. Always handle the equipment using proper lifting techniques, do not roll, climb or drill hole in the cabinets or enclosures. G1

Electric Shock

WARNING: Opening the equipment may cause terminal injury — even if the mains AC supply is disconnected. Hazardous voltages may be present inside, as large capacitors may still be charged. G2

Environmental Precautions

Ventilated Hot Surface

CAUTION: To avoid damage the equipment, **keep objects clear of system ventilation inlets, outlets and system fans**, if any, ensuring the **airflow** through the units is **not obstructed**, and that the fans rotate freely. Use caution with power modules, as they can reach **extreme temperatures** under load and normal operation. E1

Current Surge Protection

WARNING: The installer/user is responsible for ensuring that the power system is not damaged by current surges, over-voltages, etc. caused by external transients, lightning, electrostatic discharge, etc. To avoid damage and obtain the expected system reliability, it is mandatory to always install SPDs in Eltek's power supply systems. Follow the instructions given in "Guidelines for Lightning and Surge Protection", doc. 2024623. E2

Humidity & Dust Protection

WARNING: The electronics in the power supply system are designed for indoor, clean environment. When installed in outdoor enclosures — using heat sinks or closed loop heat management systems — it is important to maintain the equipment closed and tight during operation, to avoid external air entering the enclosure. Also, when using open loop heat management systems, it is important to replace the filters on a regular basis. Indoor installations in dusty or humid areas require appropriate air filtering of the room, or filtering of the air entering the power system. Follow the instructions given in "Generic Guidelines Environmental Protection.", doc. 2038879 E3

Precautions during Installation

Qualified Personnel

CAUTION: Read the user documentation carefully before installing and using the equipment, as installation and operation is to be performed as described in it. Always tighten screws and bolts with the **torque values recommended** in the documentation. For safety reasons, the **commissioning and configuration of the equipment is only to be performed** by *Eltek*'s personnel or by authorized and qualified persons. I1

EMC, NEC/CEC Regard

CAUTION: This product is tested and verified according to international safety, environmental and EMC standards. Any **non-**Eltek **equipment** installed into this product after delivery might influence the performance and **could infringe the original approvals**. The **installer is responsible** for ensuring that the environmental properties of this product/ system do not deteriorate during installation, and that it is performed in accordance with applying regulations.

Installations in USA and Canada must comply with NEC/CEC requirements. I2

Device Hazard

CAUTION: Before you start the electrical installation, you must **always disconnect** all external supply fuses, as well as internal battery and load fuses/ breakers, if any. I3

Electric Shock

WARNING: For safety reasons (high leakage current / high touch current) you must always connect the AC earth wire (PE) to the terminals, before you connect the AC input cable(s).

The batteries, if any, represent a major energy hazard. To avoid short-circuit of battery poles, you must always remove metallic objects — uninsulated tools, rings, watches, etc. — from the vicinity of the batteries. I4

Electric Shock

WARNING: 60V power systems, and higher voltage systems, are only to be installed in Restricted Access Locations (RAL). Access must be limited by use of tool, i.e. lock and key. I5

I/O Monitor Types			
Part Number	**Type**	**Description**	**Installation Guide**
242100.304	I/O Monitor	Type 1 (T1), for Outdoors applications	351503.033 (this guide)
242100.502	I/O Monitor2	Type2 (T2), generic unit without the Outdoor functions	351509.033
242100.306	I/O Monitor3	Type3 (T3), similar to Type 1 but with support for Solar hybrid functions (fuel tank and wind measurements, etc.)	351503.033 (this guide)
242100.603	FlexiMonitor	Type 5 (T5), multipurpose I/O monitor that can be used instead of T1*, T2 & T3*	351535.013
242100.604	Expansion Kit	Relay Expansion Kit, 8 relays	
242100.605	Expansion Kit	Relay Expansion Kit, 4 relays	
242100.606	Expansion Kit	LED Panel Expansion Kit	

* Note that FlexiMonitor supports no fan control functionality

Table of Contents

1. Introduction

Congratulations on your purchase of the *I/O Monitor, CAN Bus Node*, an intelligent "plug-and-play" module used to decentralize and expand the functionality of your power supply system.

About this Guide

This booklet provides you with the required information for installing the *I/O Monitor* and the *I/O Monitor3 CAN Bus Nodes* (T1 and T3) in *Eltek's* power supply systems. The booklet also presents both *I/O Monitors'* technical specifications.

For information about how to activate and configure the *I/O Monitor* and the *I/O Monitor3* nodes, click on the Help button on the toolbar of the *PowerSuite* or *WebPower* configuration programs. Or read the *Smartpack2 Master Controller* user guide (Doc 350020.013), if you use the controller's front keypad to configure the nodes.

System Diagram — CAN Bus Nodes

The *I/O Monitor, CAN Bus Node* is used as a building block in *Eltek's* power supply systems, see Figure 1. The *I/O Monitor3* and other CAN bus nodes, like the *Battery Monitor* and the *Load Monitor*, may also be connected to the bus. The nodes are powered directly from the CAN bus, and have dedicated inputs and outputs that expand the system monitoring and controlling capability.

The controller monitors and controls the whole system, and serves as the local user interface between you and the system. The *WebPower* application enables you to configure and operate the system from your computer's standard web browser.
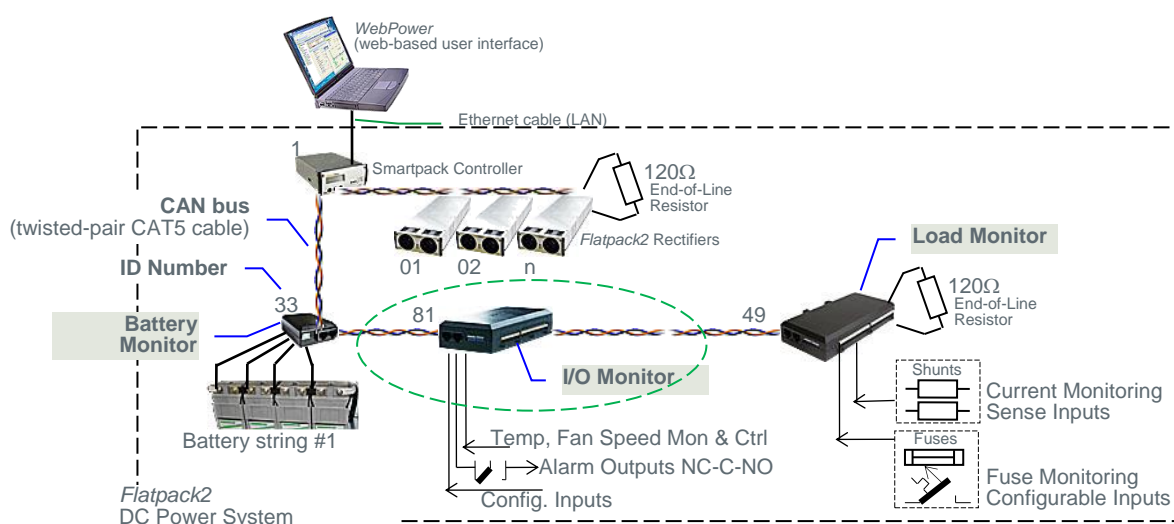

Figure 1   Example of three CAN bus nodes connected in a *Flatpack2* DC Power Supply System

2. I/O Monitor CAN Bus Nodes (T1 & T3)

Both the *I/O Monitor* (T1) and *I/O Monitor3* (T3) CAN bus nodes enable you to decentralize and increase the number of input monitoring and output controlling signals in *Eltek's* power supply systems.

Also, they can monitor and control the fan speed and compartment temperature inside fan-cooled outdoor cabinets.

The *I/O Monitor3 CAN Bus Node* (T3) is equipped with the same number of input and output signals as the *I/O Monitor* (T1)*, but it is specially developed for solar hybrid power systems, with inputs for increased precision of analogue measurements, intended to be used for fuel tank management, solar irradiation, wind measurements, etc.

Key Features

A wide range of features are implemented in the *I/O Monitor* and *I/O Monitor3 CAN Bus Nodes*, as mentioned below:

- ✓ Powered via the CAN bus; no external power supply required
- ✓ Firmware upgrade via the CAN bus (see required "SW Upload tools" on page 15)
- ✓ 6 user programmable voltage-free relay outputs for traditional remote control
- ✓ 6 user programmable and configurable inputs
  for fuse monitoring and other site equipment monitoring (precision fuel tank and wind measurements with *I/O Monitor3* nodes)
- ✓ Outdoor cabinet climate control,
  using dedicated inputs and outputs for temperature and fan control
- ✓ Storage of calibration data and real time event log
- ✓ Setup, configuration and calibration via *WebPower* in your computer's standard web browser
- ✓ Flexible mounting using DIN rail tabs or screw head slots
- ✓ Up to 14 *I/O Monitor* modules (any type) may be connected to the CAN bus
- ✓ CAN bus addressing via DIP switches

Read also chapter "Technical Specifications", page 15, for more details.

Typical Applications

The *I/O Monitor* and *I/O Monitor3 CAN Bus Nodes* are employd in *Eltek's* power systems, to implement flexible expansion and distribution of system functionality. They are also suitable in outdoor application, for climate control of fan-cooled outdoor cabinets.

The *I/O Monitor3 CAN Bus Node* can be employd in solar hybrid power systems, to implement precise fuel tank management, irradiation and wind measurements, etc.

3. Installation of I/O Monitors (T1 & T3)

You can install the *I/O Monitor* (T1 and T3) CAN bus nodes if your power system meets the following requirements:

1. You system's controller is either the *Smartpack2, Smartpack S, Compack* or the *Smartpack* controller with firmware version 2.04 (3.06 for the T3 node) or higher installed

2. You system's controller has an Ethernet port, or you have a PC with *PowerSuite* application version 2.4 (3.3 for the T3 node) or higher installed

You need standard installation tools and equipment used by an authorized electrician. NOTE: All tools must be insulated.

Safety Precautions

Follow these precautions during installation, commissioning and general handling of the power supply system.

CAUTION: For safety reasons, the **commissioning and configuration of the equipment is only to be performed** by Eltek 's personnel or by authorized and qualified persons; otherwise the warranty may be invalidated.

Please, **read the user documentation carefully** before installing and using the equipment, as installation and operation is to be performed as described in it.

Basic Installation Steps

Carry out these steps to install the *I/O Monitor* (T1) or the *I/O Monitor3* (T3) CAN bus node in your power system.

Power is ON!

1. **Assign the *I/O Monitor*'s CAN bus address**, by
   setting the *I/O Monitor*'s DIP switches. Read to chapter "CAN Bus Addressing", page 12

2. **Connect the node to the CAN bus**, by
   e.g. using a CAN bus cable and moving the CAN bus termination plug from the controller to the last connected *I/O Monitor*.
   Read chapter "CAN Bus Termination" page 11

3. **Attach the *I/O Monitor* to a suitable surface**;
   Read chapter "Fastening the I/O Monitors", page 8

4. **Connect the required input and output cabling to the terminals**;
   Read chapter "Connection Drawing", page 9

5. **Configure the *I/O Monitor* (T1) or *I/O Monitor3* (T3)** node's operation,
   using *WebPower* in your standard web browser or the *PowerSuite* application, read chapter "Configuration in PowerSuite", page 13
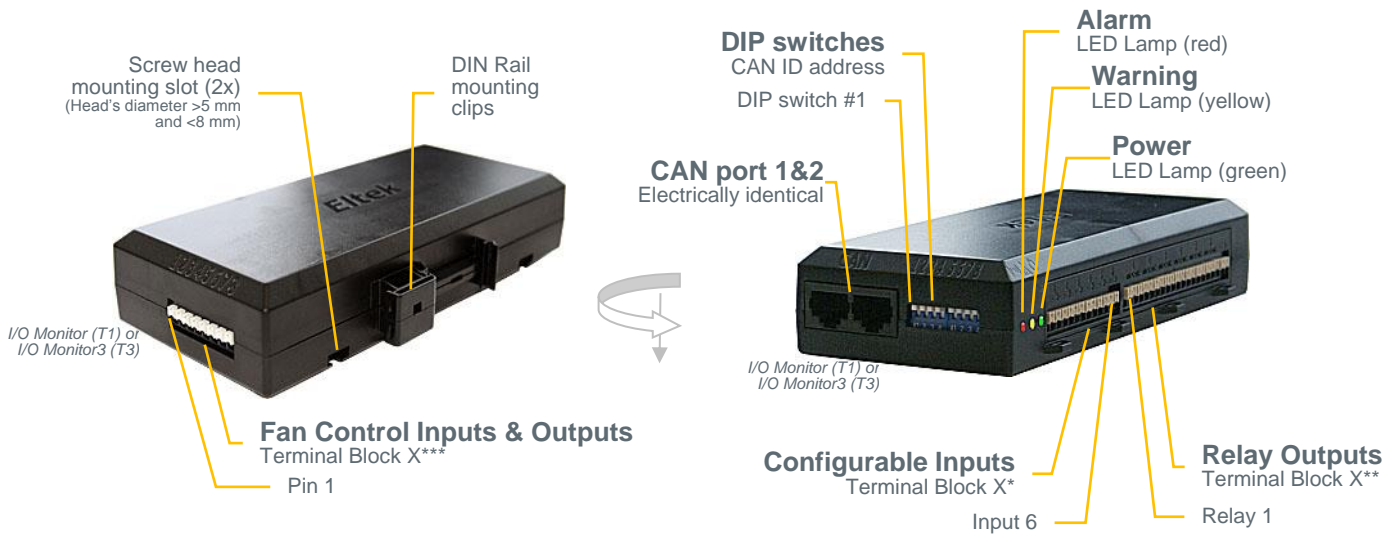
Location of Connectors, Ports, LEDs

Figure 2   Location of terminals, DIP switches, CAN ports and LED indicators in the I/O Monitor (T1) and I/O Monitor3 (T3)

CAN port 1 and 2 are electrically identical, and are used to enable connection of the CAN bus incoming and outgoing CAT5 cables, or the RJ45 CAN bus termination plug.

Refer to chapter "Connection Drawing", page 9, for a complete list of signals, pin-out, etc.

LED Indicator	Illumination Status	Description
Power	OFF	The monitor has NO supply
	ON green	The monitor has supply
Warning	OFF	No Warning
	ON yellow	Warning (Non-critical alarm)
Alarm	OFF	No Alarm
	ON red	Alarm (Critical Alarm)
Other	Green ON & Red Flashing	Supply voltage too low
	Green OFF & Red Flashing	Firmware boot-loading

Table 1   Description of the *I/O Monitor*'s LED illumination status

Fastening the I/O Monitors (T1 & T3)

You mount the *I/O Monitor* (T1) and the *I/O Monitor3* (T3) CAN bus nodes inside the power cabinet or subassembly, using the node's DIN rail mounting clips, see "Figure 2", page 8.

You may also mount 2 screws on a suitable surface and slide the enclosure's mounting slots on the screws heads. Max. head's height is 3 mm, and head's diameter is to be between 5 and 8 mm, see "Figure 2", page 8.

Connection Drawing

Use this drawing as a connection reference for all cabling. You find the exact location of connection terminals, plugs and DIP switches, by referring to chapter "Location of Connectors, Ports, LEDs", page 8.

The figure shows the position of the relay contacts (NC, NO) when the relay coils are de-energized (alarm mode).
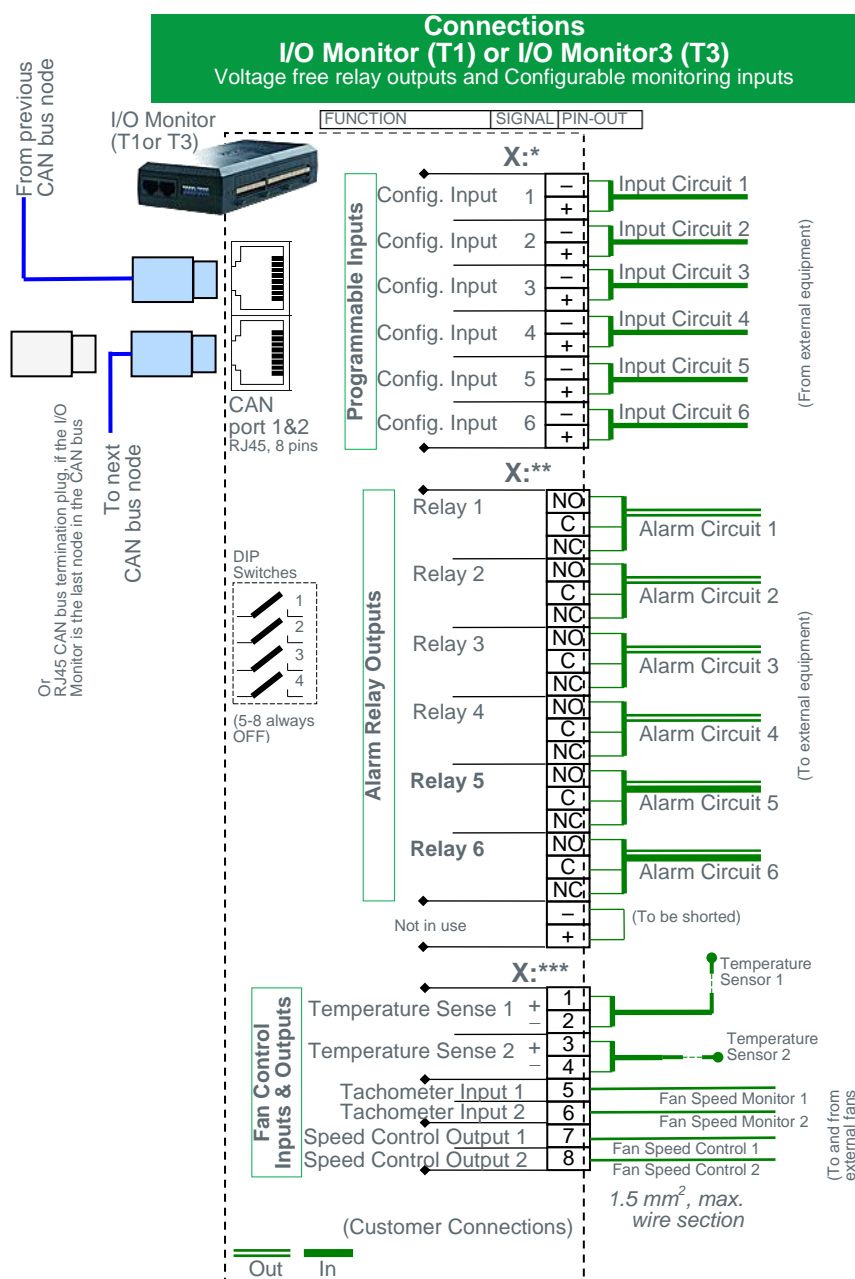

Figure 3   Connection drawing for I/O Monitor (T1) or I/O Monitor3 (T3) CAN bus nodes

For more details, read chapters "Climate Control Signals ~ I/O Monitor (T1 and T3)" page 10, "Signal Differences ~ I/O Monitor (T1) vs I/O Monitor3 (T3)" page 10 and "Technical Specifications", page 15.

Climate Control Signals ~ I/O Monitor (T1 and T3)

Both the *I/O Monitor* (T1) and *I/O Monitor3* (T3) CAN bus nodes are equipped with input and output signals to monitor and control the fan speed and compartment temperature inside fan-cooled outdoor cabinets.

The two inputs "**Temperature Sense 1**" and "**Temperature Sense 2**" are designed to be used with the AD590 series of temperature sensors, e.g. to monitor the temperature inside fan-cooled outdoor cabinets.

The two inputs "**Tachometer Input 1**" and "**Tachometer Input 2**" are developed to monitor the rotational speed of two individual fans. The fan speed is displayed as a percentage of the maximum speed. In order to convert the signal frequency on the tachometer inputs to the correct percentage speed, the inputs must be configured with the number of pulses per revolution (ppr) and with the maximum fan speed (rpm).

The two outputs "**Speed Control Output 1**" and "**Speed Control Output 2**" are designed to individually control the speed of two independent fans. The outputs can be configured to give a linear control signal from 0V (0% fan speed) to 10V (100% fan speed).

Warning: To prevent damaging the *I/O Monitor's* Speed Control Outputs, do not connect clamping diodes directly on the fans' control inputs. Also, the input impedance of the fans' control inputs must be 10KΩ or greater.

Relays 5 and 6 have higher contacts rating, and are suitable for fan control and other current demanding equipment. For example, they can be used for driving external control relays for switching the fans ON/OFF, instead of using the Speed Control Outputs.

Read chapter "Technical Specifications", page 15, for more details

Signal Differences ~ I/O Monitor (T1) vs I/O Monitor3 (T3)

The *I/O Monitor3 CAN Bus Node* (T3) is equipped with the same number of input and output signals as the *I/O Monitor* (T1), but it is specially developed for solar hybrid power systems, with inputs for increased precision of analogue measurements, intended to be used for fuel tank management, solar irradiation, wind measurements, etc.

Input	*I/O Monitor (T1)*	*I/O Monitor3 (T3)*
1	**Type:** NO/NC, Pull Up/Dn, Diode Matrix **Range:** 0-75V (78mV resolution)	**Type:** NO/NC, Pull Up/Dn, Diode Matrix **Range:** 0-75V (78mV resolution)
2	(same as input 1)	(same as input 1)
3	(same as input 1)	**Type:** NO/NC **Range:** 0-10V (13mV resolution)
4	(same as input 1)	**Type:** NO/NC **Range:** 0-10V (13mV resolution)
5	(same as input 1)	**Type:** NO/NC **Range:** 0-10V (13mV resolution) OR 4-20mA (27µA resolution)
6	(same as input 1)	**Type:** NO/NC **Range:** 0-10V (13mV resolution) OR 4-20mA (27µA resolution)

The two inputs "**Config. Input 5**" and "**Config. Input 6**" are designed for accurate analogue current measurements of fuel tank level, wind measurements, etc. But they can also be used for voltage measurements.

Read chapter "Technical Specifications", page 15, for more details

CAN Bus Termination

To ensure a correct bus communication and avoid data reflection, you must always terminate the CAN bus with two 120Ω resistors, one at each end of the line (60Ω bus impedance).

Eltek power systems are shipped from factory with the CAN bus already terminated with 120Ω resistors. The **CAN bus termination** is implemented with a special RJ45 plug with built-in 120Ω end-of-line resistor.
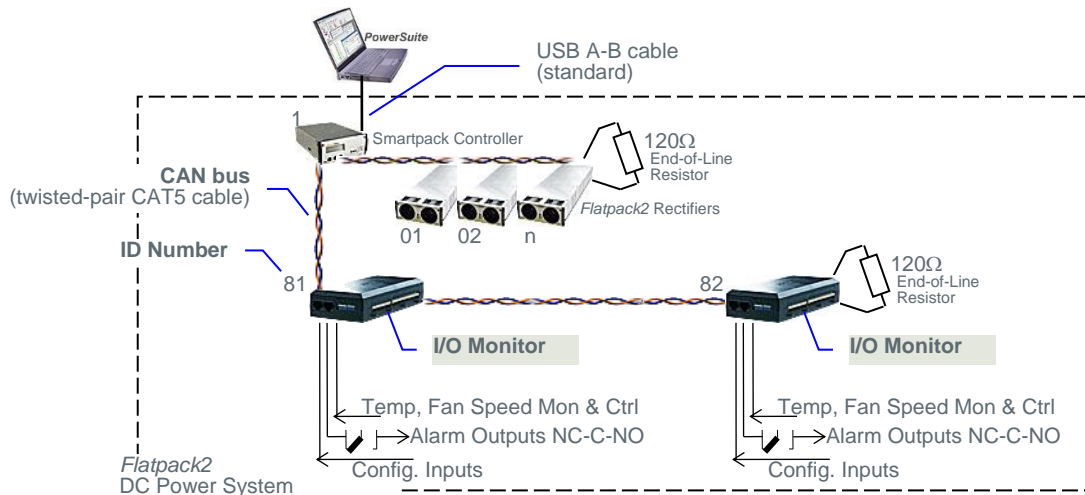

Figure 4   Example of CAN bus addressing and termination in a *Flatpack2* system with two "*I/O Monitors*" connected the CAN bus

When connecting *I/O Monitor* nodes (max. 14 nodes of any type) to the CAN bus, you have to remove the CAN bus termination plug from one of the CAN bus ends — e.g. from the controller's CAN port — and plug it on one of the CAN ports on the last connected *I/O Monitor* node.

Configuration

When connecting *I/O Monitor* nodes (T1 or T3) to the power system's CAN bus, you have to configure each of the *I/O Monitors* by:

1. **Setting the DIP switches** with the correct CAN bus address,
   to assign a unique ID number to the *I/O Monitor*, read chapter "CAN Bus Addressing", on page 12

2. **Configuring the *I/O Monitor* node**'s operation,
   using the controller's keypad or *WebPower* in your standard web browser or the *PowerSuite* application, read chapter "Configuration in PowerSuite", page 13

CAN Bus Addressing

The power system controller dynamically software-assigns ID numbers to rectifiers. The controller registers the rectifiers' ID numbers — or CAN bus address (01, 02…) — together with their Serial Numbers (software assignment).

Other control units make use of DIP switches for configuring their unique CAN bus ID number (hardware assignment). The ID numbers (81, 82…94), for *I/O Monitors* (of any type T1, T2, T3), are assigned by DIP switches on the nodes' side.

A maximum of 14 *I/O Monitor* nodes (of any type T1, T2, T3) may be connected to the CAN bus.

I/O Monitor (T1&T3)
DIP switch configuration

ID <81>
(All switches OFF)

I/O Monitor	ID #	DIP Switch Position 1 —2 —3 —4
1st Monitor	81	OFF—OFF—OFF—OFF
2nd Monitor	82	ON—OFF—OFF—OFF
3rd Monitor	83	OFF—ON—OFF—OFF
4th Monitor	84	ON—ON—OFF—OFF
5th Monitor	85	OFF—OFF—ON—OFF
6th Monitor	86	ON—OFF—ON—OFF
7th Monitor	87	OFF—ON—ON—OFF
8th Monitor	88	ON—ON—ON—OFF
9th Monitor	89	OFF—OFF—OFF—ON
10th Monitor	90	ON—OFF—OFF—ON
11th Monitor	91	OFF—ON—OFF—ON
12th Monitor	92	ON—ON—OFF—ON
13th Monitor	93	OFF—OFF—ON—ON
14th Monitor	94	ON—OFF—ON—ON

Note:
- DIP switch positions 5 through 8 are always to be OFF

- The monitor's ID # corresponds to the DIP switch's binary value plus 81

Table 2 DIP switch addressing for I/O Monitor (T1) and I/O Monitor3 (T3)

Configuration in PowerSuite

To activate and configure the *I/O Monitors* (T1 & T3) specific settings, use the controller's keypad or other GUI as *WebPower* or *PowerSuite*. For example, using the *PowerSuite* PC application, version 2.3 or higher, you connect to the power system's controller, either via an Ethernet connection or via USB port, if accesible.
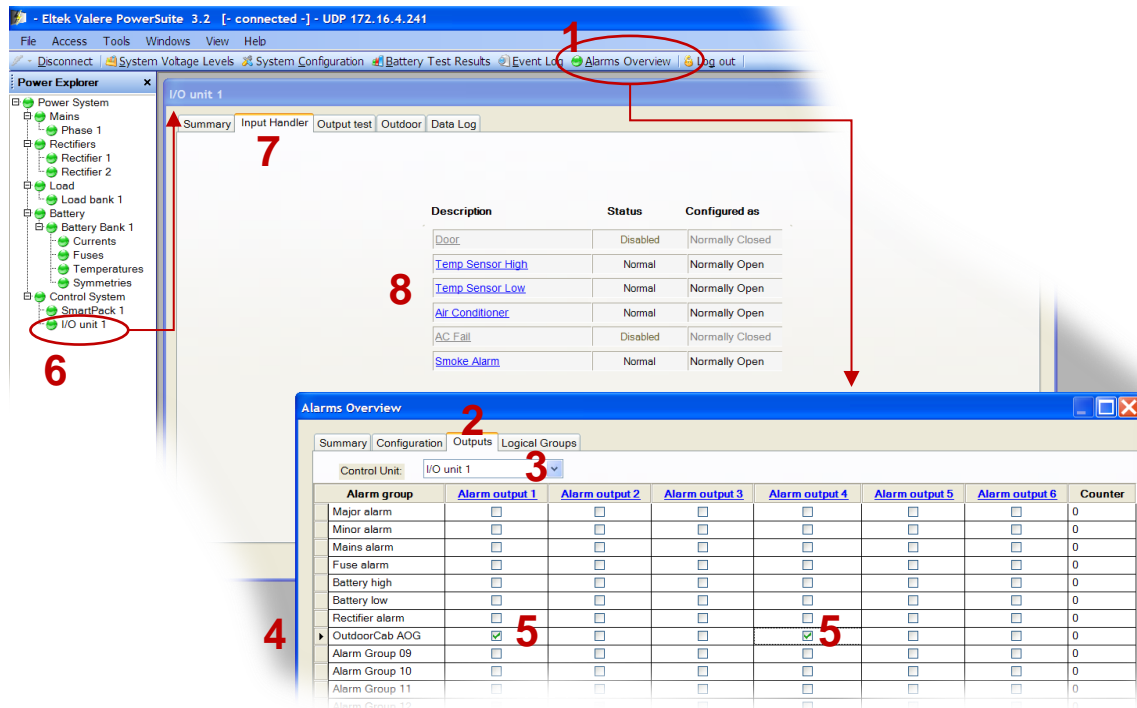

Figure 5   Example of I/O Monitor configuration in PowerSuite

In general, the connected *I/O Monitor* node(s) are displayed in the *PowerSuite's* Power Explorer pane (6), under the *Control System node*, see "Figure 5", page 13.

For configuring the *I/O Monitors (T1 & T3)* outputs:

A. Click on the "Alarms Overview" icon on the toolbar (1), then on the dialog box's "Outputs" tab (2)
B. Display the *I/O Monitor's* alarm relays by selecting the acual "I/O Unit X" in the Control Unit's drop down list (3)
C. If required, click and define an "Alarm Group", e.g. "OutdoorCab AOG" (4)
D. Check the "Alarm Output X" relays (5) to assign to the Alarm Output Group, e.g. Alarm Output 1 and 4

For configuring the *I/O Monitors (T1 & T3)* inputs:

A. Open the *I/O Monitor*'s icon under the *Control System node* (6)
B. Click on the "Input Handler" tab (7)
C. Click on the alarm monitor links (8) "Temp Sensor High", "Air Conditioner", etc. (enable the input, change the description, select the input activation type, the event or system internal action, the alarm output group or relays to activate, etc.)

For configuring the *I/O Monitors (T1 & T3)* Climate Control signals: (see "Figure 6")

A. Open the *I/O Monitor*'s icon under the *Control System node* (1)
B. Click on the "Outdoor" tab (2)
C. Click on the "OutDoorTemp XX.Y" alarm monitor links (3)
   to configure the two **Temperature Sense inputs**
   (enable the input, select the event or system internal action, the alarm output group
   or relays to activate, calibrate and configure the input activation type, etc.)

   (The fan configuration below requires login with Factory Access Level)

D. For Fan 1 (4) and Fan 2 (5), click on the "FanControl XX.Y" alarm monitor links,
   to configure the two **Fan Speed Control outputs**
   (configure the temperature vs speed, calibrate the speed vs output voltage, select the
   interval preasure test and humidity reduction parameters, etc.)

E. For Fan 1 (4) and Fan 2 (5), click on the "FanSpeed XX.Y" alarm monitor links,
   to configure how to monitor the fan speed with the two **Tachometer Inputs**
   (enable the input, select the limits and alarm output group or relays to activate,
   configure the max. fan speed (rpm) vs the pulses per revolution (ppr), etc.)

F. For Fan 1 (4) and Fan 2 (5), click on the "SpeedDev XX.Y" alarm monitor links,
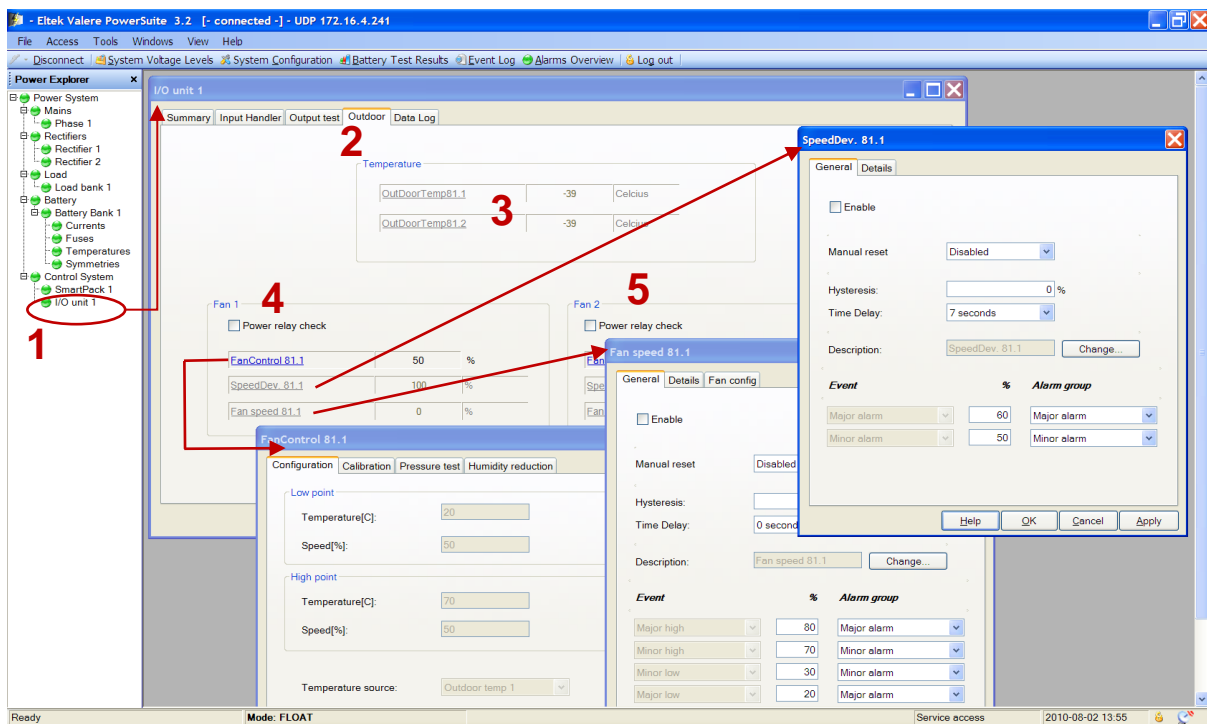   to configure alarm limits for devitiations of the fan speed

Figure 6   Example of I/O Monitor Climate Control signal configuration in PowerSuite

For more detailed description of how to configure the CAN Bus nodes, read the *PowerSuite* application's **Online Help**.

Installation Guide *I/O Monitor CAN Bus Nodes (T1&T3)*   351503.033, Issue 2.2, 2015 Oct

4. Technical Specifications

I/O Monitors: [1]-Outdoor / [2]-Type 2 / [3]-Type 3

6 configurable inputs: "digital", voltage/current measurement

o NO/NC, Pull Up/Dn, Diode Matrix Voltage range 0-75V (78mV res)	$\Rightarrow$ No1-6[1,2], No1-2[3]
o NO/NC, Voltage range 0-10V (13mV resolution)	$\Rightarrow$ No3-6[3]
o Current measurement 4-20mA (27µA resolution)	$\Rightarrow$ No5-6[3]

6 configurable relay outputs: normally activated/deactivated

o Dry/Form C, Max 1A/60W/75V	$\Rightarrow$ No1-4[1,3], No1-6[2]
o Dry/Form C, Max 8A/300W/75V	$\Rightarrow$ No5-6[1,3]

Outdoor cabinet specific ports: temp, fan control/monitoring

o 2xTemp sensor inputs (-40-100℃ with 0.14℃ res.)[1,3]
o 2xFan speed inputs (0-5V or pulse sense 1-10 p/r)[1,3]
o 2xFan speed control outputs (0-10V, max -10/+20mA) [1,3]

Max. CAN Power consumption	Max 3.4W[1,2,3]
SW Part number	402088.009[1,2,3]
Functionality	Data logging (non-volatile memory)
	o 10000 time stamped logs
	o 4 user selectable data points
	o Default: 2x Temp. 2x Fan Speed

All CAN Nodes

Max. nodes	14 units of same type can be added a single CAN bus (Also see CAN Power)
Mounting	Slotted groove for post mounting or DIN rail/Velcro (for Battery Monitor)
Visual Indication	3xLED (1xLED CAN Power) o GREEN: Power o YELLOW: Warning o RED: Alarm (Flashing LED: insufficient power)
SW Upload tools	Smartpack2 Master through CAN or FWLoader v3.25 or newer and IXXAT USB-to-CAN Converter (p/n: 208565)
Casing material	Plastic - V0 rated / Steel (CAN Power)
Operating temp	-40 to 70℃ (-40 to 158°F) Storage temp -40 to 85℃ (-40 to 185°F)

Applicable Standards

Electrical safety	IEC 60950-1 UL 60950-1 CSA C22.2
EMC	IEC 61000-6-1 IEC 61000-6-2 IEC 61000-6-3 /A1 IEC 61000-6-4 ETSI EN 300 386 v1.3.3 FCC Part 15B Subpart 109
Environment	2002/95/EC (RoHS) & 2002/96/EC (WEEE) ETS 300 019-2-1 Class 1.2 ETS 300 019-2-2 Class 2.3 ETS 300 019-2-3 Class 3.2

Specifications are subject to change without notice
242100.CAN.DS3 – v3 (part)

Part Numbers

Part no.	Description
242100.304	I/O Monitor Type 1 (T1) Outdoor Applications
242100.502	I/O Monitor2 Type 2 (T2) Generic Applications
242100.306	I/O Monitor3 Type 3 (T3) Outdoor and Solar Hybrid Applications