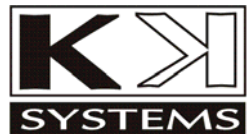


KDMON User Manual



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Safety Warning

The KDMON is not authorised for use in any situation where injury or death could result from its failure. No interface should be connected to a dangerous potential.

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1. KDMON Overview

The KDMON is a system monitoring device which can monitor

- analog voltage –30V to +30V
- analog current 4-20mA (a 20V sensor supply is provided)
- the presence/absence of data on an RS485 bus
- the contents of registers in an RS485 MODBUS Slave device
- an external relay contact (uses the analog voltage input)

It can be configured to generate alarms based on the above, which are notified by

- SMS text message
- Email (SMTP)
- Fax (Group 3)

A wide range of alarm conditions and notification options can be configured via an RS232 configuration port, using a Windows-based configuration program.

An external RS232-attached modem is required. The modem type depends on the type of notification configured.

SMS transmission requires a GSM modem which can be an industrial GSM model (e.g. Siemens TC35, Cinterion MC52i/MC55i/BGS2T), or a data-capable GSM or satellite phone which supports the GSM/Hayes command set.

SMS provides additional features which are not available via email or fax:

- Triggering of simulated alarms, and resetting of alarms
- Setting KDMON real time clock
- SMS to email gateway for system testing

Email transmission requires a specific modem: Cinterion MC52i , MC55i or BGS2T. This is an industrial GSM modem with GPRS capability and an internal TCP/IP stack and which can optionally be DIN rail mounted.

Fax transmission requires a modem which supports Class 1 or Class 2 fax (not Class 2.0). We recommend the Cinterion GSM models. Not all GSM networks support fax however; for example in the UK, 2011, only Vodafone and Virgin support it.

1.1. Quick Start Guide

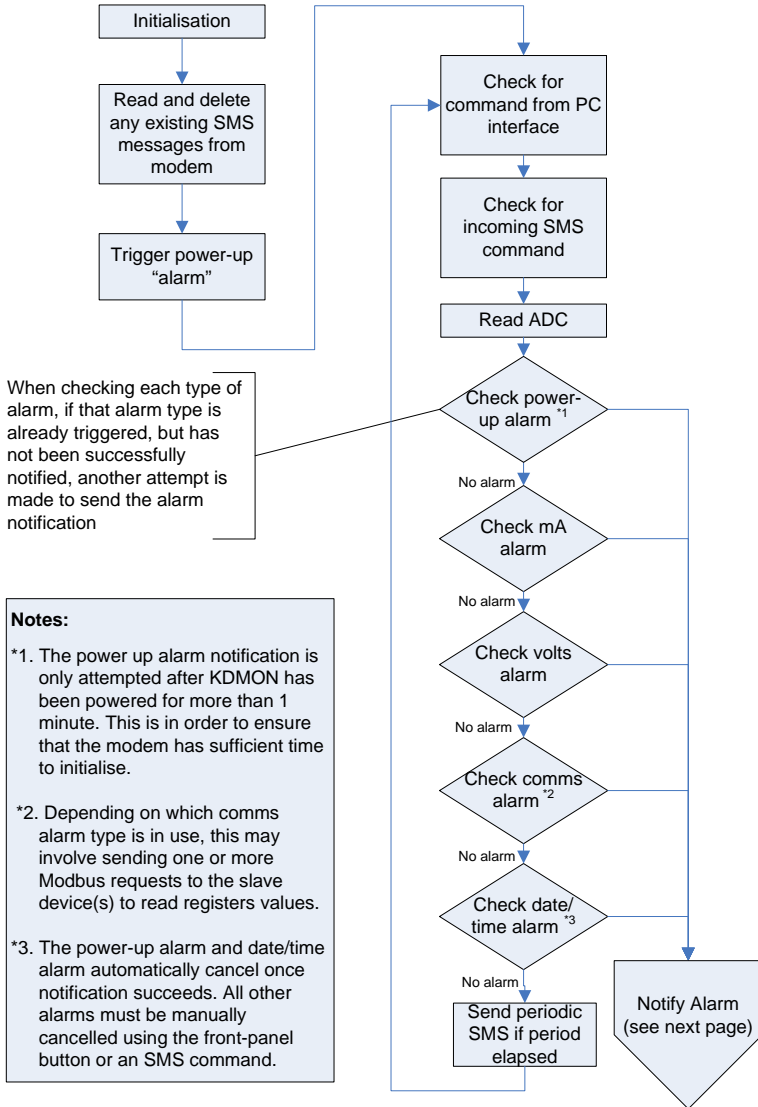
- Unpack the unit and check you have the following items:

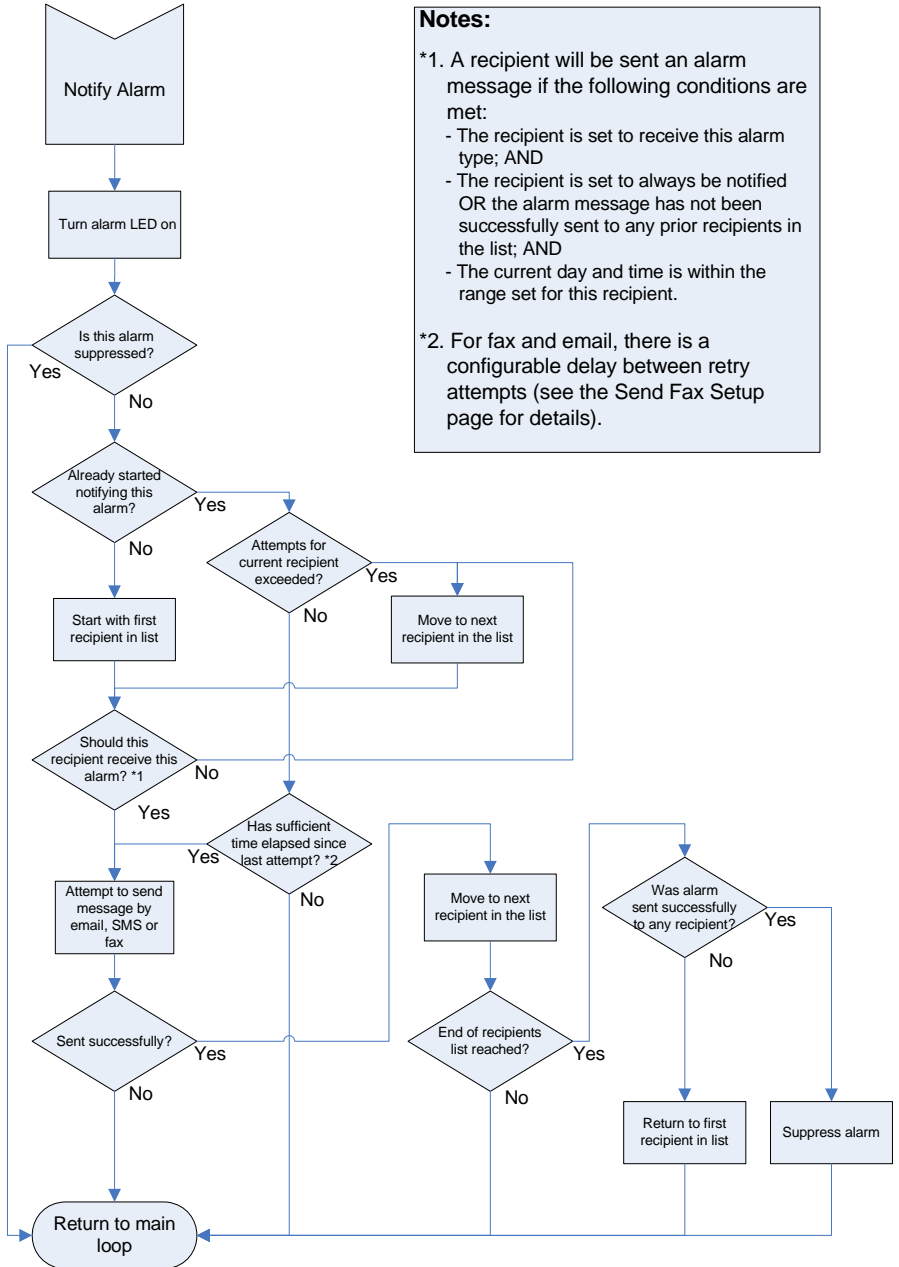
KDMON
CAB-001 configuration cable
DB9-DB9 null modem adaptor

If you have ordered the modem, this should be included in the package also.

- Connect up the KDMON to a Windows computer, for configuration as shown on page 16.
- Refer to the configuration section on page 26 and set up the required alarms.
- Install the KDMON with the modem, as per the wiring diagram on page 18.

1.2. KDMON Operation Flow Chart





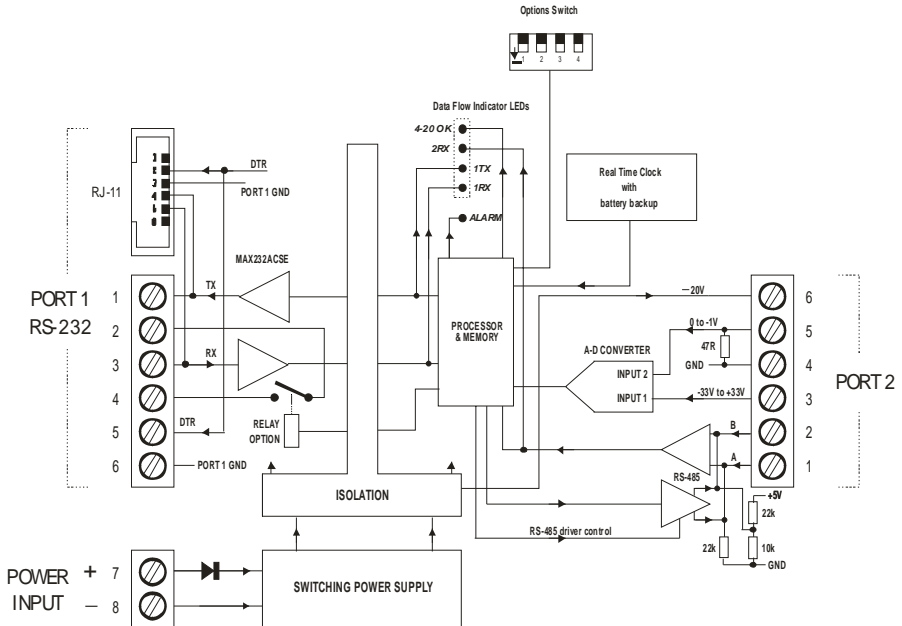
Notes:

*1. A recipient will be sent an alarm message if the following conditions are met:

- The recipient is set to receive this alarm type; AND
- The recipient is set to always be notified OR the alarm message has not been successfully sent to any prior recipients in the list; AND
- The current day and time is within the range set for this recipient.

*2. For fax and email, there is a configurable delay between retry attempts (see the Send Fax Setup page for details).

1.3. Block Diagram



Port 1 is RS232 and is used for the modem. It also serves as a configuration port; all KDMON features are configured using a supplied Windows program.

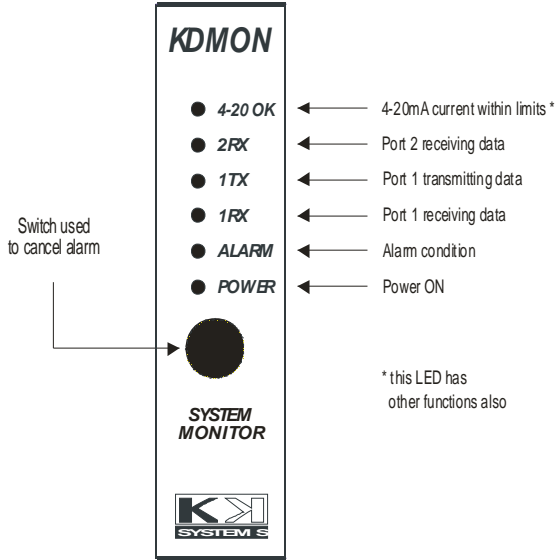
Port 1 is also duplicated on an RJ-11 connector. A dual purpose cable (usable for both a modem and the PC configuration program) is supplied and it uses this connector.

Port 1 also carries the Relay Option. This is a normally-open relay contact, rated at 1A/30V DC, which can be closed by an alarm, for a programmed period.

Port 2 is a composite connection for the two analog (voltage and current) features, and for the 2-wire RS485 interface.

The grounds (pin 6 on Port 1 and pin 4 on Port 2) should always be connected to earth – even if no connections are made to the other pins of the terminal block(s). This is to eliminate the potential for static charge and optimise EMC compatibility.

1.4. Front Panel Description



The front panel functions are mostly self-explanatory.

The 4-20 OK LED illuminates when the current drawn by the 4-20mA analog sensor is within those limits. This LED also indicates A-D converter activity; this takes place approximately every second. Only the general (continuous) state of this LED indicates whether the 4-20mA current is within its limits.

1.4.1. Resetting Alarms

If any alarms are triggered, this will be indicated by the Alarm LED being on. A momentary press of the front panel push-button will reset all alarms and will switch off the Alarm LED.

Avoid holding this button for more than a second as this will reset the KDMON. Holding the button for 3 or more seconds will put the KDMON into a special mode that suspends normal operation (indicated by the alarm LED flashing continuously). If this occurs, the KDMON will need to be power-cycled in to restart its normal mode.

1.4.2. Checking GSM signal strength

The front panel push-button (also used to cancel alarms) can be pressed momentarily when no alarm is triggered in order to request and indicate the current GSM signal strength from the modem (where the modem supports this feature). The signal strength is reported by flashing the alarm LED between 0 and 6 times (where 0 indicates no signal, 1 flash indicates very low signal and 6 indicates maximum signal strength).

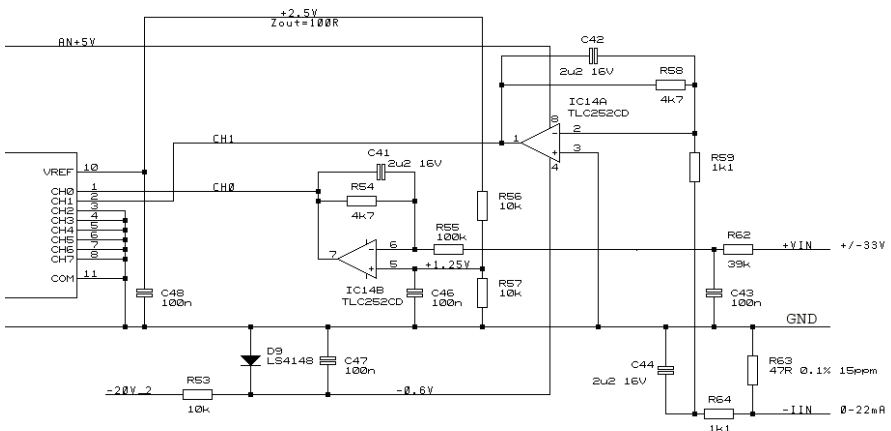
1.5. Options Switch

Options Switch



This switch is currently unused.

1.6. KDMON Analogue Input Circuitry



The KDMON has two analogue inputs: voltage and current. An understanding of the internal implementation of these is not usually necessary but may be useful in some applications.

1.6.1. Voltage Input

There are three particular aspects to be aware of:

The A-D converter has a finite resolution of 12 bits; 1 part in 4096 or 0.025%. The voltage input range is -33V to +33V. If the voltage range you are measuring covers this range, you will get the full 0.025% resolution. If however you are measuring a much smaller voltage range e.g. just 0 to +1V then the resolution will drop to 1.6%. The absolute accuracy of the measurement will be similarly affected.

The input resistance of the voltage input is not infinite; it is about 140k ohms. This means that if the source resistance of your voltage source is e.g. 1.4k ohms, you will get a 1% measurement error.

When the voltage input has nothing connected to it, it floats up to +1.25V and this value is returned by KDMON alarms. This incidentally enables the sensing of e.g. an isolated relay contact connected between the voltage input and its analogue ground, by connecting the relay contact across the KDMON voltage input and setting an alarm threshold of e.g. +0.6V.

1.6.2. Current Input

This is designed for standard 4-20mA transducer transmitters. The current is passed through a 47 ohm resistor and the voltage drop across this resistor is measured, using the 12-bit A-D converter.

The measurable current range is 0 to 22mA and the 12-bit A-D conversion gives a resolution of 0.025% i.e. 6uA.

The KDMON provides an unregulated -20V output (which approximately tracks the KDMON supply voltage, minus 4 volts) for powering the 4-20mA transducer. To use this supply, connect it to the negative terminal of the transducer, and connect the positive terminal of the transducer to the KDMON current measurement input. Consult the wiring.

1.6.3. Relay Contact

This is a normally-open contact which can be closed when an alarm occurs. It opens after a programmed time or when the alarm is cleared.

The contact is isolated from the rest of the KDMON. The isolation is not production tested but will withstand 100V DC peak. See the Specification section for the rating of the contact itself.

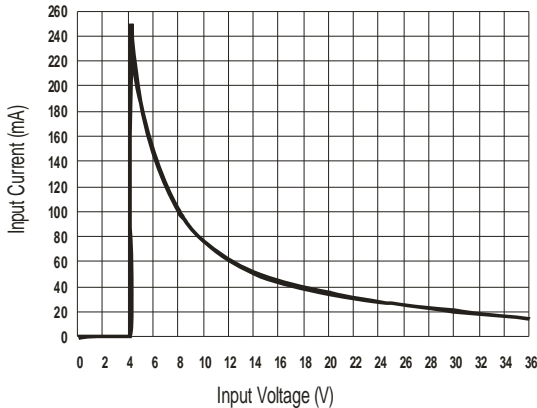
1.6.4. KDMON Analog Measurement Accuracy

We specify the voltage/current measurement accuracy at 1% of full scale, over the specified temperature range. The actual factory calibration procedure is done at room temperature to around 0.05%.

1.7. Power Requirements

The power supply specification depends on the mode of operation.

The KDMON power input is 11-35V DC, 2 watts max. The constant power nature of the internal power circuitry means that at a higher supply voltage it will draw less current. The following diagram shows the relationship



The peak current which occurs around 4V can reach 600mA.

Input must reach the startup voltage (typ. 4V, guaranteed 7V) in less than 1 second otherwise the power supply will not start up.

This means that a power unit needs to be rated at 300mA, to handle the startup current, even though the KDMON will draw much less at say 24V.

However, the 20V output (provided for powering a 4-20mA analog sensor) is not regulated and approximately tracks the KDMON supply voltage, minus 4V. This output is intended to work with a 24V power input to the KDMON.

Finally, if the modem is powered from the same power unit, its requirements need to be considered too. The Cinterion modem requires 8-30V DC. The manufacturer does not publish a full specification of the power requirements; merely recommending a minimum 1A source, adding that the actual current is 200mA at 12V or 100mA at 24V.

The combination of the above means that the most useful power unit will be 24V and rated at 1.3A or higher.

1.8. Choosing a Modem and a Network

Modems

The KDMON has been designed for maximum compatibility with a standard-spec GSM industrial modem, which is why there is no “modem type” configuration option. The SMS and fax functions should work with most GSM modems, mobile phones and satellite phones with an RS232 interface.

However, KDMON's email functionality requires nonstandard command set extensions in the modem and only the Cinterion (formerly Siemens) MC52i (dual band) and MC55i and BGS2T (quad band) industrial models are supported. The email function uses GPRS.

Full KDMON operation (SMS, fax, email) is guaranteed only with the two above Cinterion modem types.

Other modems tested are the widely used Siemens/Cinterion TC35, the Nokia 6310i phone (with a DLRP3 cable), and the Thuraya/Hughes 7100 satellite phone. These devices all support SMS features, as should any GSM modem with an RS232 interface. The TC35 and the 6310i support fax also.

Traditional land-line modems should mostly support fax and in some cases can transmit SMS messages via a 3rd party message centre. However, very few land-line modems remain in production and their compatibility is variable. The KDMON fax functionality has been tested with the INSYS INT 2.1 industrial land-line modem <http://www.insys-icom.com/insys-modem/> which works without any special KDMON configuration.

Satellite Phones

We are currently testing various models.

The leading manufacturers are Thuraya and Iridium. Thuraya offers a low cost but less reliable product. Iridium is several times more expensive but is the choice of most professional users.

All satellite phones also require GPS reception and this needs to be considered when locating the phone or, if using an external antenna, the antenna itself.

The Thuraya 7100 satphone supports SMS only. There are significant issues with satphone SMS in that message transfer to terrestrial GSM networks can be very slow (delays up to

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some hours) or unsupported altogether. For example, in the UK, Thuraya has message transfer agreements with O2, Vodafone, Orange and T-Mobile.

Networks

The KDMON is network independent and is not aware of which network SIM card is in the modem.

Both PAYG and contract SIM cards may be used. The choice of PAYG/contract, and which network to use, is according to the usage.

For very light usage, especially if using just SMS, a PAYG SIM will be the best choice. Most UK networks will disconnect a PAYG SIM card if no chargeable event has occurred for 3-6 months, and the KDMON has a configurable option to transmit an SMS every X days, to keep the SIM card valid. Most networks provide a web administration facility for checking and topping up the credit, and (in the UK) Virgin and T-Mobile offer the best of these, with the ability to administer multiple SIM cards under one web login.

Note that setting up of the web administration for a particular PAYG SIM card usually involves the network sending an SMS message to it for ownership verification purposes, which means the SIM card needs to be inserted into a normal GSM phone first.

For heavier usage, and where easy administration is required, a contract SIM card may be more appropriate because it avoids the need for a manual top-up, and can come with an allowance of e.g. 500 SMS messages per month, free internet data, etc. There are also specialised contract SIM products, aimed at this type of low use data-only (no voice) industrial application which have very low monthly payments.

It is difficult to make recommendations on which network to use, because they are very similar. It is probably true that Vodafone has the “technically best” product, with best coverage, and the best performing network. However, most other networks offer better pricing and other important features.

At time of writing, Virgin and T-Mobile offer good web facilities for administering multiple PAYG SIM cards under a single web login.

Some networks' SIM cards are sold with “data” disabled by default and will not work for email until “data” is enabled.

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UK Networks

The KDMON has been tested with PAYG SIM cards from the main UK networks, with the following results:

Network	SMS	Email	Fax	APN username password	SMTP provided by network
<i>Vodafone</i>	Y	Y	Y	pp.vodafone.co.uk web web	No
<i>Orange</i>	Y	Y	N	orangeinternet user pass	No
<i>T-Mobile</i>	Y	Y	N	general.t-mobile.uk user wap	smtp.t-email.co.uk
<i>Virgin</i>	Y	Y	Y	goto.virginmobile.uk user [blank]	No
<i>O2</i>	Y	Y	N	mobile.o2.co.uk mobileweb password	smtp.o2.co.uk

If the network provides an SMTP server, as shown above, the username and password are usually blank.

This is a useful website for the network configuration information:

<http://www.filesaveas.com/gprs.html>

For the latest network configuration information, or for configuration of contract SIM cards, please contact the network.

APN

Neither the KDMON nor the Cinterion modems support the auto-APN protocol so you need to obtain the APN from the network provider and configure it in the KDMON. The auto-APN protocol is in any case not 100% reliable.

Reliability of KDMON Alarm Notifications

Obviously, no means of transmitting an alarm message is 100% guaranteed.

SMS delivery can be delayed by minutes or hours. There are also cases where one network will not deliver messages to another one, though this seems to be mostly confined to roaming, or messages sent or received by satellite phones.

Email delivery can be compromised by spam filters. Many email recipients are not aware that their incoming email is filtered, and the filtering rules can change from time to time. If your email provider offers a "whitelist" or a "trusted senders" option, it is advisable to thus whitelist the email address configured in the KDMON From: header.

Fax delivery is perhaps the most reliable, because it needs only the two telephone lines to be working - until the receiving fax machine runs out of paper. And only a few networks support fax.

For best assurance of message delivery, configure an alarm to generate an SMS and an email concurrently, and use a contract SIM card so the credit cannot easily run out.

1.9. Specification

RS232 interface:	Receiver threshold +1.5V. Hysteresis 500mV typ. Receiver input Z 5k Ω typ. Transmitter output +/-8V into a 3k Ω load.
RS485 interface:	Receiver threshold 200mV typ (differential). Hysteresis 70mV typ.
Voltage monitoring:	-30V to +30V. Input Z 100k Ω min Source Z 100 Ω max (for best accuracy) Measurement accuracy 1% Absolute maximum input -60V to +60V
Current monitoring:	4mA to 20mA. Sensing resistance 47 Ω . Measurement accuracy 1% Absolute maximum current 50mA
20V output:	Within 17V to 23V with a 24V DC KDMON power input. Current limited at 30mA typ; short circuit protected (1 minute)
Isolation:	3-way isolated (Port 1 - Port 2 - Power In) 64V PK, tested at > 1000V AC RMS, 1 second. All Port 2 features share a common ground (pin 4).
Relay Contact:	1A at 30V DC or 0.3A at 125V AC. Isolated from KDMON to 64V PK (isolation is not production tested).
Environmental:	Operating temperature -20C to +50C. Storage temperature -25C to +70C. Relative humidity 0 to 90%, non-condensing.
Ventilation:	Rail-mounted KDMON must have a 50mm gap above and below.
EMC compliance:	Emissions EN50081-2 (94). Immunity EN50082-2 (95)
Dimensions:	29mm (W) x 114mm (H) x 97mm (L) approx in rail-mounted position, incl. screw terminals.

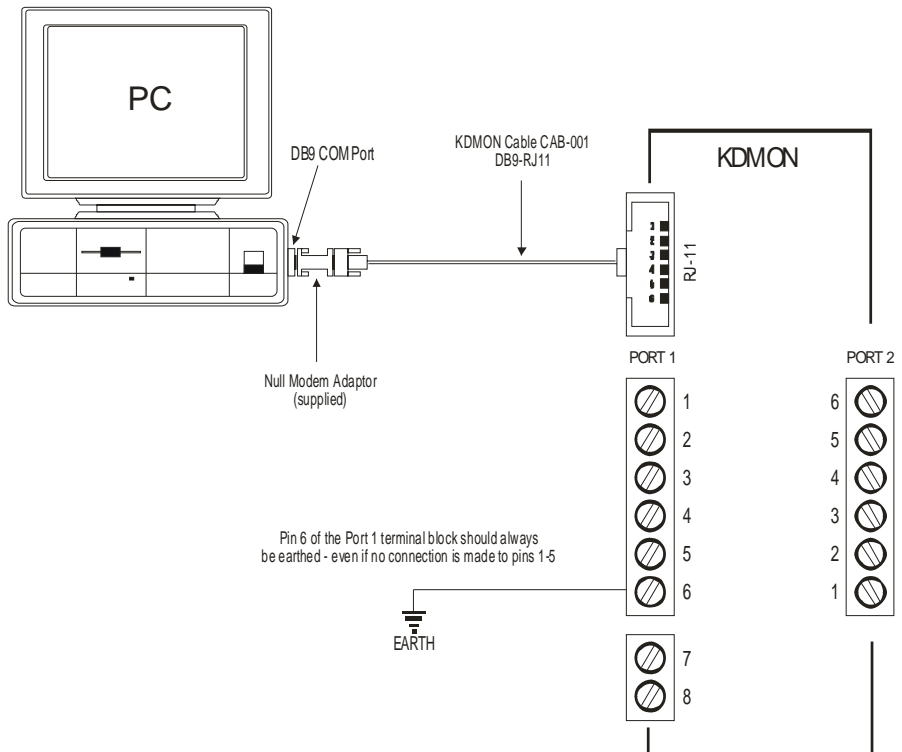
2. Ports and Connections Reference

2.1. RS232 Port - KDMON Configuration

Port 1 has two functions: KDMON configuration, and the modem connection.

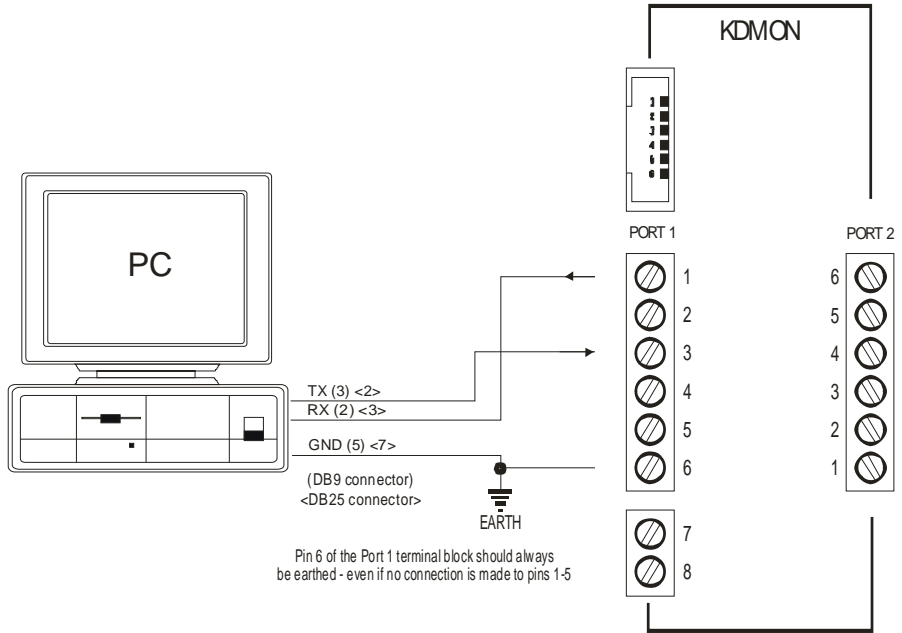
Port 1 is duplicated on the 6-way "Port 1" terminal block and on the RJ-11 connector. Only one of these two connectors may have connections to it at any one time.

The supplied CAB-001 cable can be used for both configuration and modem connection. For convenience, it plugs into the RJ-11 connector. The connection to a standard 9-way IBM PC RS232 port requires the supplied null modem adaptor as shown below:

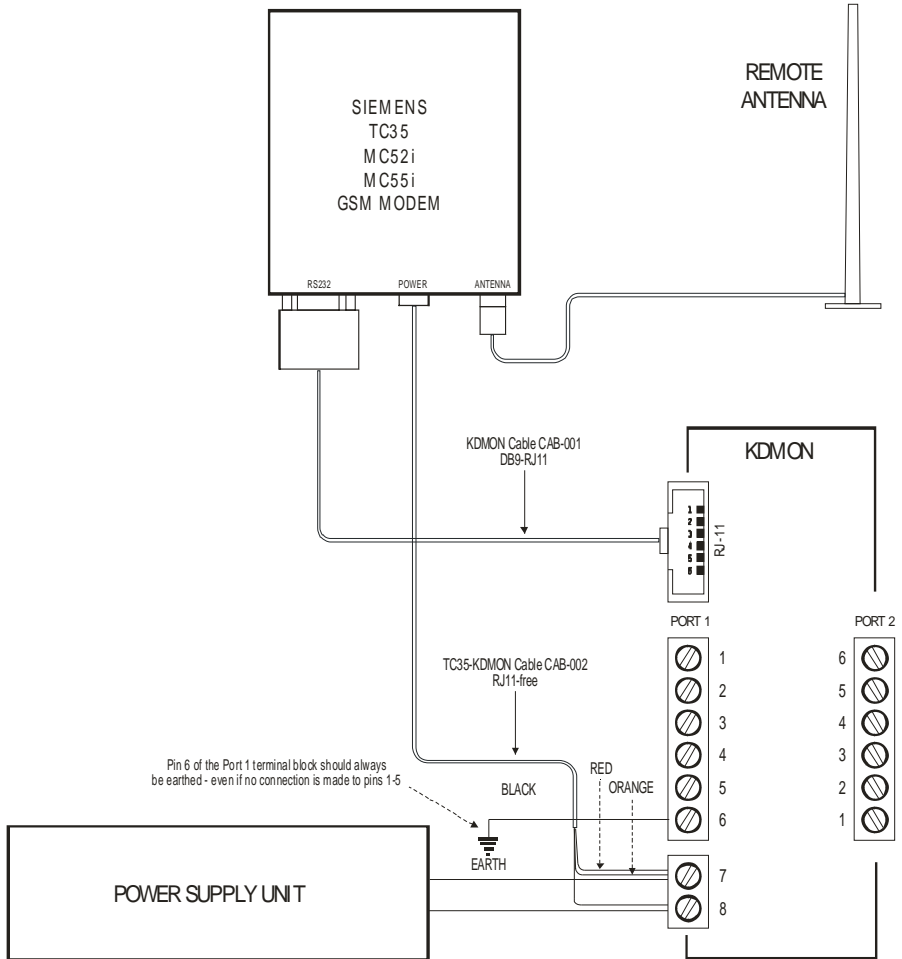


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For installations where the CAB-001 cable is not used, the following diagram shows the alternative configuration connections to the "PORT 1" 6-way terminal block:

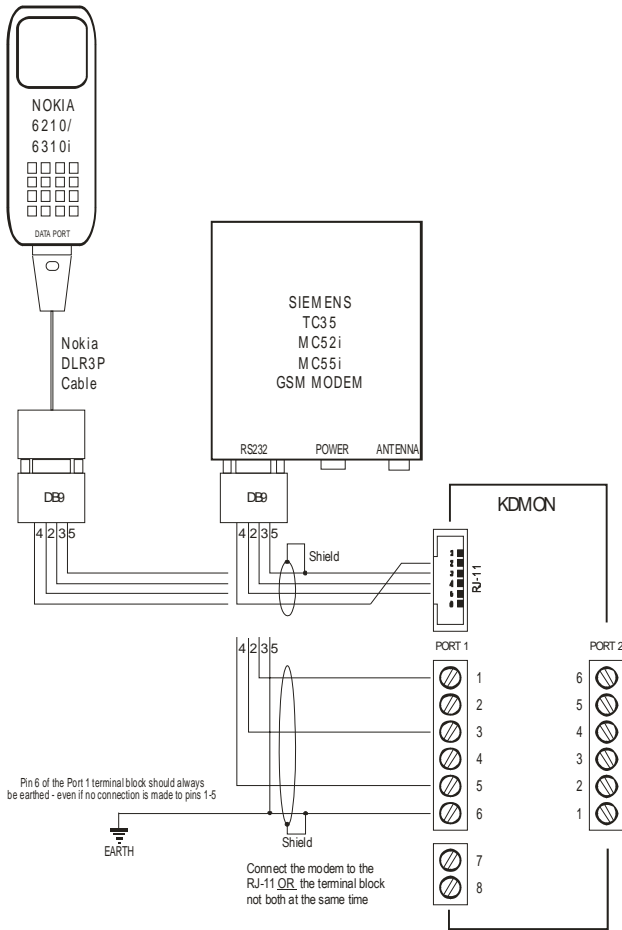


2.2. RS232 Port - TC35/MC52i/MC55i Modem Connections



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For installations where the CAB-001 cable is not used, the following diagram shows the alternative modem connections to the "PORT 1" 6-way terminal block:



This shows the connections to both an old Nokia 6310i phone and the recommended Cinterion (formerly Siemens) GSM modem. There are many "industrial GSM modems" on the market but KDMON compatibility will need to be verified by the user. Some of them may have issues confined to the fax functionality but SMS may work fine - or vice versa.

2.3. Relay Option

This is a normally-open relay contact which can be used to switch a variety of loads. It can be closed by any of the normal KDMON alarms. It can be configured to open when the front panel button is pressed, when a general alarm reset is received via SMS, or after a configurable number of seconds (1 to 65535).

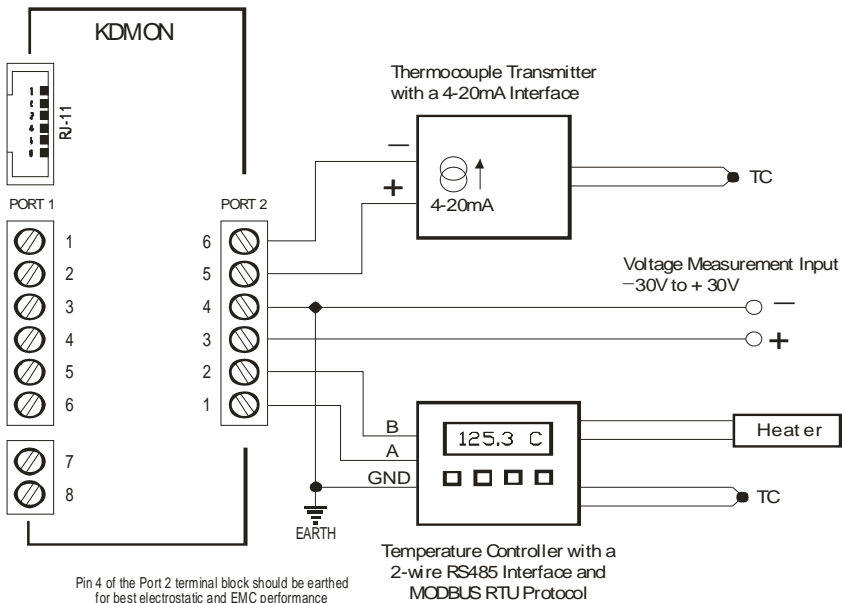
In addition, the relay contact is directly controllable with SMS commands.

If switching an inductive load (e.g. the coil of a larger relay) a snubber (suppressor) should be connected across the load to absorb the arcing.

The closure of the relay contact is inhibited with hardware for approximately 5 seconds following KDMON power-up.

2.4. Monitoring Port (Port 2)

The following diagram shows all three monitoring functions: 4-20mA, voltage measurement, and Modbus RTU device polling. KDMON can operate all three concurrently.



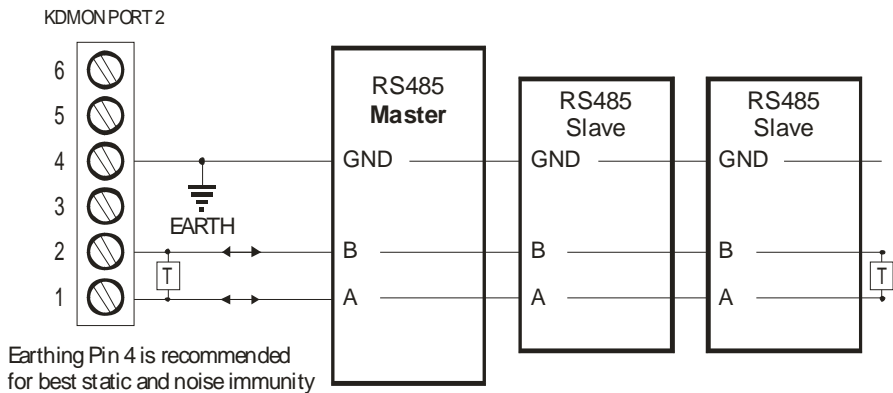
Important: KDMON isolation is between Port 1, Port 2, and the power input. The various features on Port 2 are NOT isolated from each other and they share a common ground (pin 4).

2.5. Monitoring Port - RS485 Connections

The 2-wire RS485 interface on Port 2 comprises of the standard 3 wires: A, B and Ground which are on pins 1, 2 and 4 respectively.

Modbus Device Monitoring

KDMON can act as a Modbus RTU Master as shown in the diagram on the preceding page, and can read values from a single Slave and trigger alarms on them. This functionality is limited to 2-wire RS485:



Generic RS422/485 Bus Monitoring

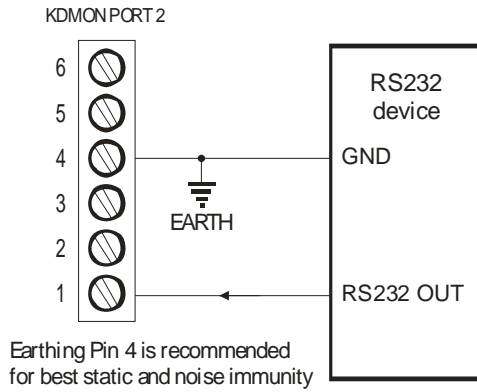
KDMON can also act as a protocol-independent comms monitor, and trigger an alarm upon a specific byte sequence, or a lack of bus activity. This function works on 2-wire RS485, or on either half (the installer has to choose) of a 4-wire RS485 or RS422 system. The above diagram applies, except that pins 1,2 are purely inputs.

RS485 Bus Termination

On cable runs exceeding around 300 metres, two terminators should be connected as shown. Each terminator should be a resistor equal in value to the characteristic impedance of the cable which for good quality data communication twisted pair cables is around 110 ohms. For best results a 10nF capacitor should be in series with the resistor; this eliminates the DC loading of the termination resistor.

RS232 Monitoring

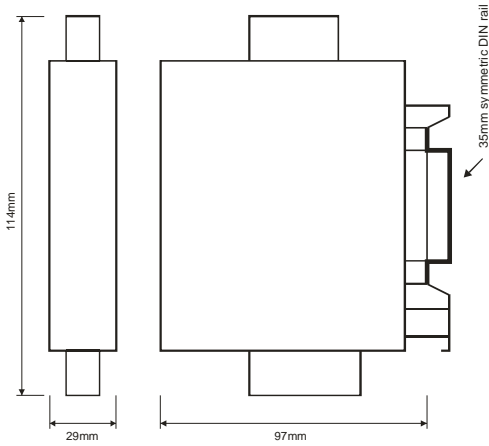
The RS4xx port is also capable of withstanding RS232 voltages in the range -12V to +12V, on pin 1 as shown below. The input threshold is +1.5V.



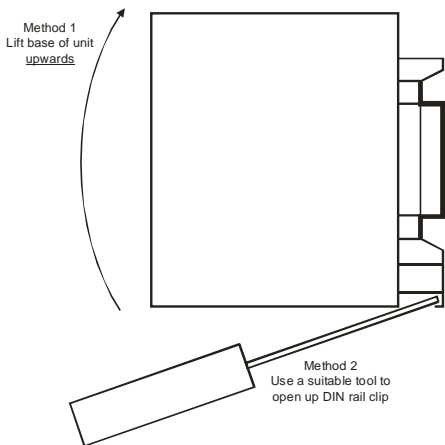
3. Mounting

The KDMON clips to a standard 35mm DIN rail

KDMON Dimensions
(including terminals)



Removing unit from DIN rail

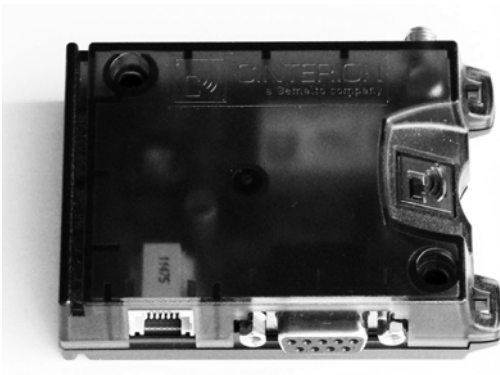


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The following illustrates a KDMON mounted alongside the Cinterion TC35/MC52i/MC55i modem. The modem is mounted using the optional DIN rail mounting kit



Alternatively, the Cinterion BGS2T modem may be used, but it has a different antenna connector (SMA) to the MC models (FME)



4. Configuration

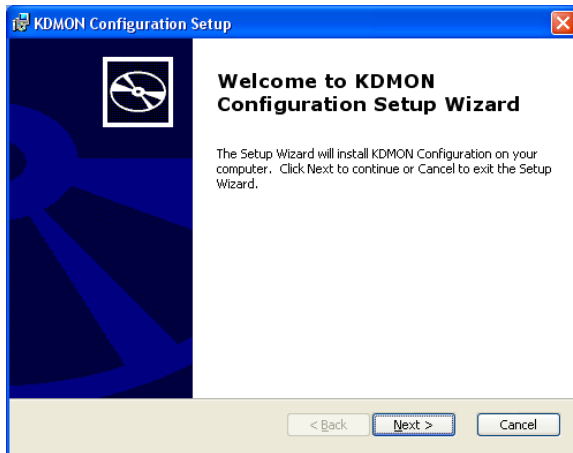
The KDMON is configured for use by connecting a PC serial port to the KDMON (port 1) and running the supplied KDMON configuration program (KDMONCFG.EXE). This software provides an easy to use interface for configuring all aspects of the KDMON. This includes specifying alarm trigger conditions, alarm messages and configuring lists of SMS, email and fax recipients who may receive alarm notifications at different times of day.

To connect to the KDMON, use the supplied CAB-001 configuration/modem cable. This is shown on page 16.

For PCs that do not have an RS232 port, a USB to RS232 converter is available from KK Systems Ltd.

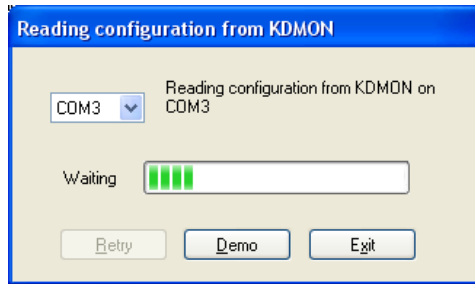
4.1. *Installing KDMON Configuration Software*

To install KDMONCFG.EXE, click on the KDMONCFG.MSI file and follow the instructions provided.



4.2. *Using KDMON Configuration Software*

With the KDMON connected to the PC serial port and powered up, start the KDMON Configuration program from the shortcut in the Window "Start" menu. You should see the following:



Select the PC port that the KDMON is connected to (or press Demo to explore the program without actually having the KDMON connected).

It is recommended that KDMONCFG is started during the first minute after KDMON is powered up. This is because KDMON uses the same RS232 port (port 1) to communicate with the modem and it does so periodically and is not checking for KDMONCFG commands during those times. During the first minute following power-up, KDMON does not do any modem comms.

Do not press the front panel button prior to or during configuration.

4.3. *Configuring Alarm Triggers*

The KDMON can be configured to trigger alarms due to any of the following events occurring:

Voltage - If the voltage measured by the analog-digital converter (ADC) goes inside or outside of the configured range.

Current - If the current drawn by the ADC is inside or outside of the configured range.

Comms - The KDMON comms port can be configured to monitor for alarm conditions in one of four ways:

- If no data is received within a specified time;
- If a sequence of bytes is received that matches a configured pattern;
- If a specified value is read from a Modbus slave device connected to the KDMON.

- If an irrecoverable error occurs while attempting to communicate with a Modbus slave device

[Day/Time](#) - The KDMON can be configured to trigger an alarm regularly at a specified day and time. This can be used to report periodic voltage or current measurements or to read values from a Modbus slave device.

[Power-Up](#) - The KDMON can trigger an alarm whenever it powers up.

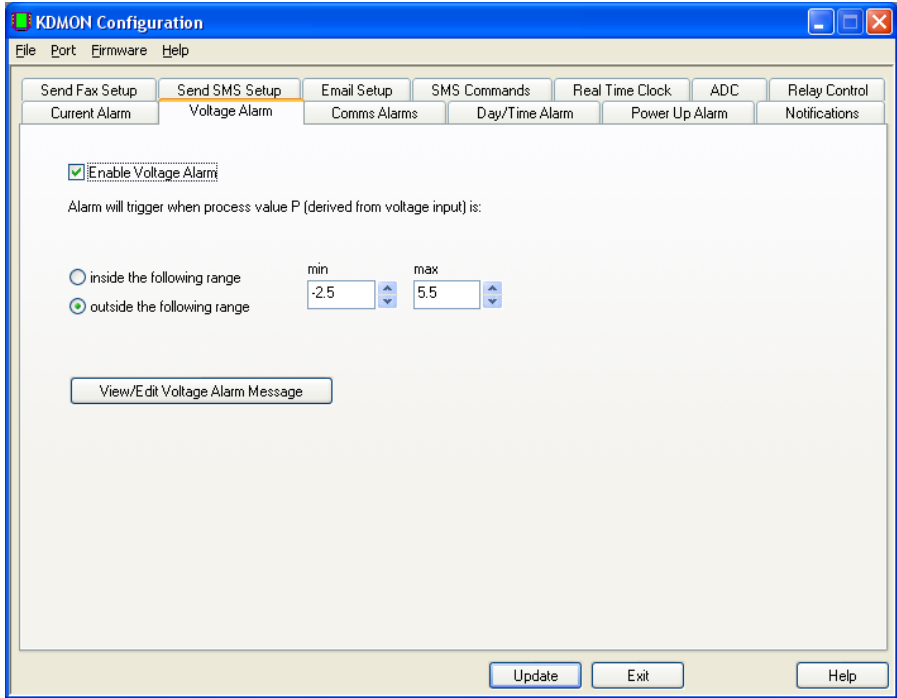
With the exception of the day/time and power-up alarms, once an alarm has triggered it must be [reset](#) before further alarms of the same type can trigger.

If an alarm is triggered, it does not prevent other types of alarms triggering: the KDMON will continue to monitor events and may still trigger other alarm types when an alarm is triggered and not reset.

Whenever an alarm is triggered, KDMON will attempt to notify the nominated recipients of that alarm type. See ["Configuring Alarm Notifications"](#) for how to configure notifications and recipients.

4.3.1. Voltage Alarm

Select the "Voltage Alarm" tab to configure the KDMON voltage alarm trigger:



On this page you can enable or disable the voltage alarm with the "Enable Voltage Alarm" checkbox. Voltage and current measurements are sampled at a configurable interval (see the ["Configuring the A to D Converter"](#) for more details).

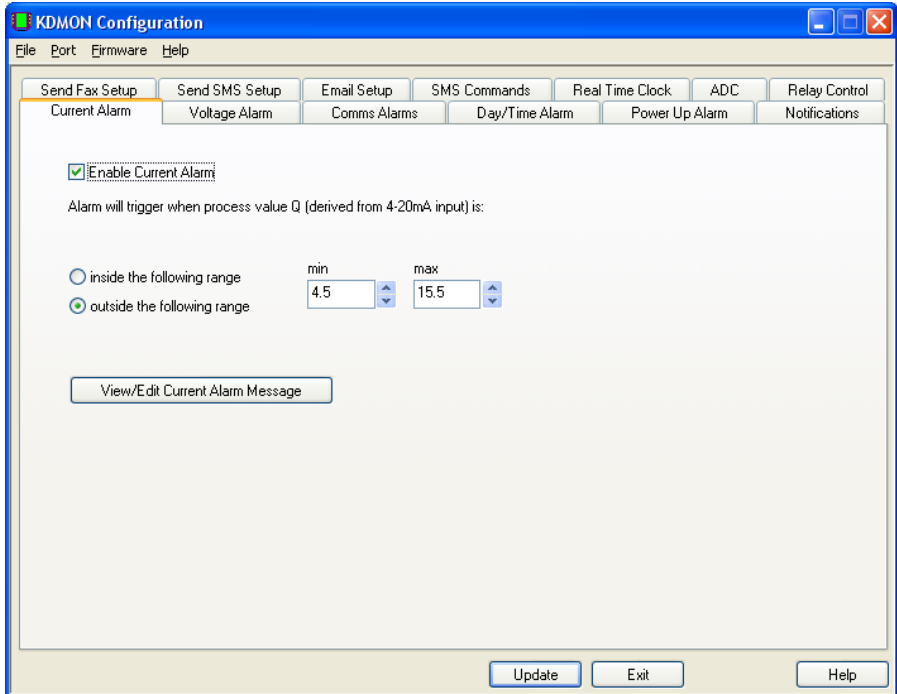
When "Enable Voltage Alarm" is checked, you can edit the minimum and maximum values of the voltage range and can choose whether the alarm should trigger when the voltage is inside or outside of the configured range.

Note that the voltage process value (P) is derived from the actual ADC voltage channel reading according to a formula which should be configured using the ADC page (see ["Configuring the A to D Converter"](#) for more details).

Press the "View/Edit Voltage Alarm Message" button to display the message that will be sent to fax or SMS recipients when this alarm is triggered (see ["Editing Alarm Messages"](#) for more information on the format of alarm messages).

4.3.2. Current Alarm

Select the "Current Alarm" tab to configure the KDMON current alarm trigger:



On this page you can enable or disable the voltage alarm with the **Enable Current Alarm** checkbox. Voltage and current measurements are sampled at a configurable interval (see the ["Configuring the A to D Converter"](#) for more details).

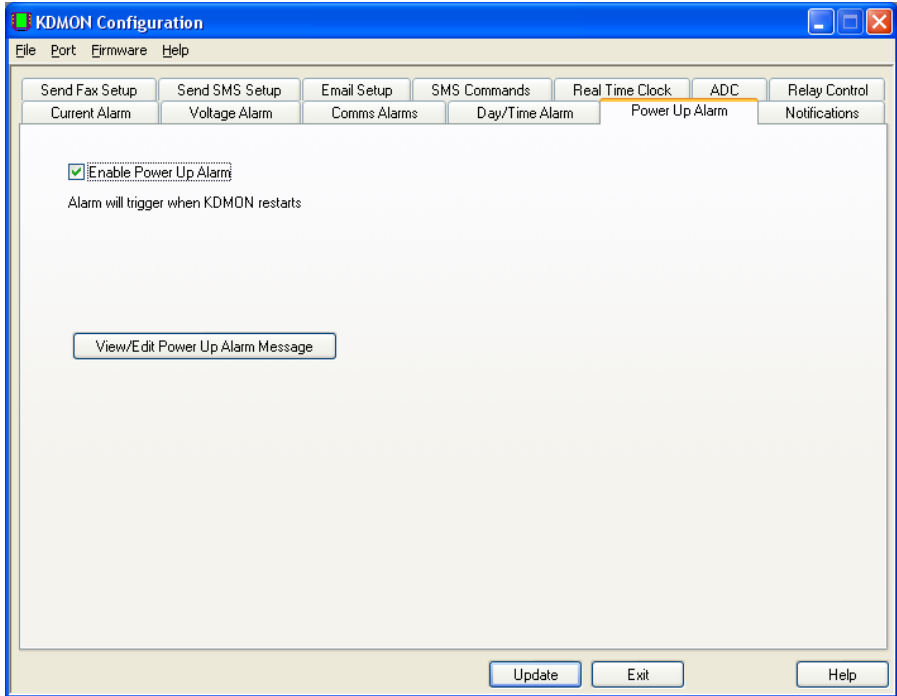
When **Enable Current Alarm** is checked, you can edit the minimum and maximum values of the current range and can choose whether the alarm should trigger when the current is inside or outside of the configured range.

Note that the current process value (Q) is derived from the actual ADC voltage channel reading according to a formula which should be configured using the ADC page (see ["Configuring the A to D Converter"](#) for more details).

Press the **View/Edit Current Alarm Message** to display the message that will be sent to fax or SMS recipients when this alarm is triggered (see ["Editing Alarm Messages"](#) for more information on the format of alarm messages).

4.3.3. Power-up Alarm

Select the "Power Up Alarm" tab to configure the KDMON power-up alarm trigger. This alarm can be used to generate a notification whenever the KDMON power is cycled - for example, in the event of a momentary power outage.



On this page you can enable or disable the day/time alarm with the Enable Power Up Alarm checkbox.

When Enable Power Up Alarm is checked, you can press the View/Edit Power Up Alarm Message to display the message that will be sent to fax or SMS recipients when this alarm is triggered (see ["Editing Alarm Messages"](#) for more information on the format of alarm messages).

At the moment that the power-up alarm is generated, some peripheral information may not be available to the KDMON and the GSM signal strength (%G) may be incorrectly reported.

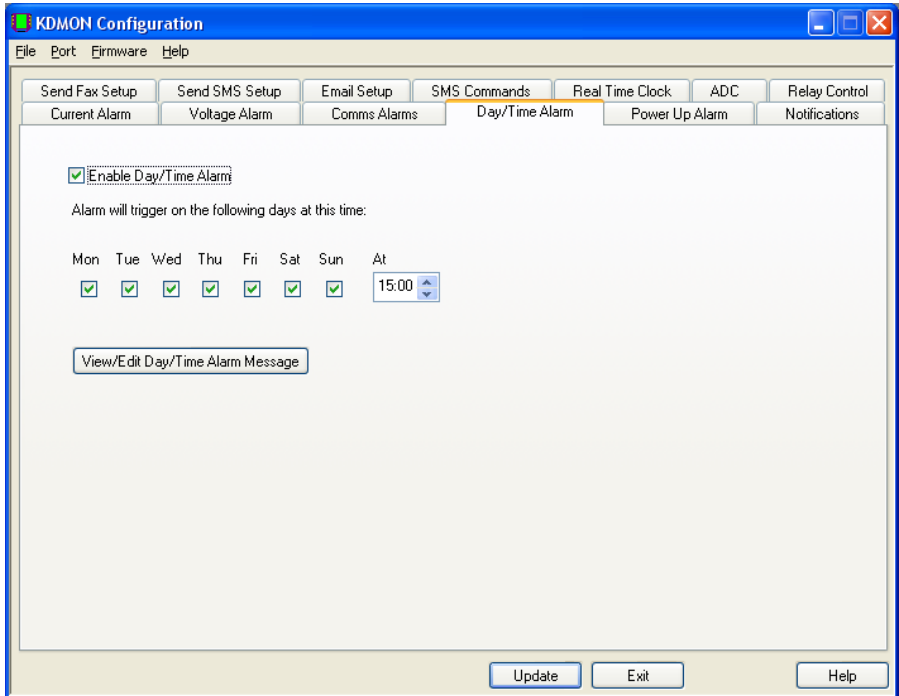
To ensure that the modem is likely to be in a suitable state to send the notification of the power-up alarm (as the modem is also likely to have been power cycled), the KDMON

delays the first notification attempt of this alarm until 60 seconds have elapsed since power-up. This delay allows sufficient time for the modem to register with most networks in order to be ready to send an SMS message, some networks however may require more time before they are able to send email. In these cases, email notification of the power-up alarm may be unreliable.

If enabled, the power-up alarm is automatically cleared once a notification message has been successfully sent to any appropriate recipients.

4.3.4. Day/Time Alarm

Select the "Day/Time Alarm" tab to configure the KDMON day/time alarm trigger. This alarm can be used to generate a notification at a particular time on any day(s) of the week.



You can use this alarm trigger to send periodic reports including the most recent voltage and/or current measurements, or values read from a Modbus slave device.

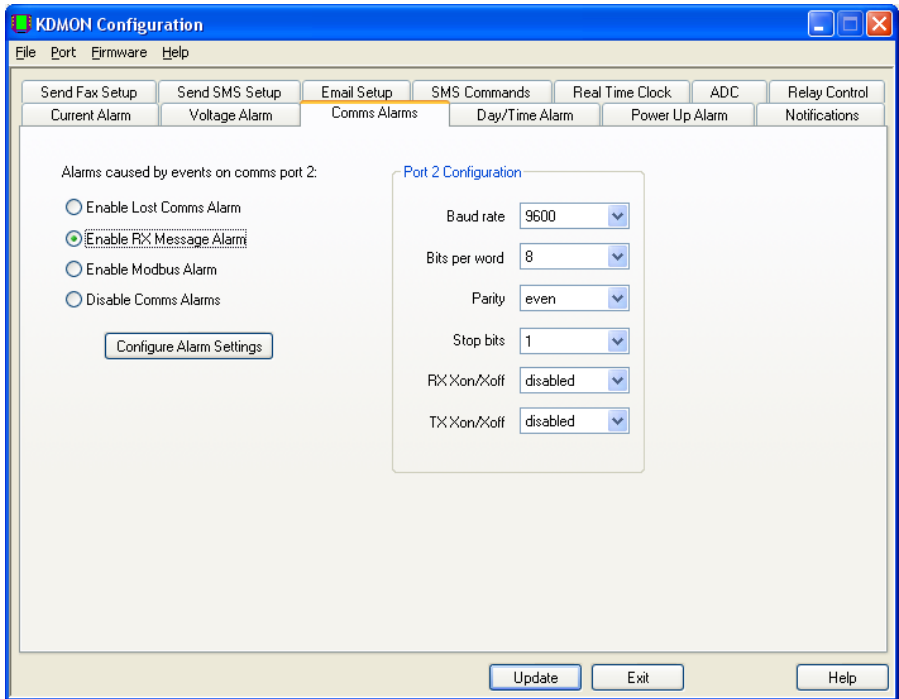
On this page you can enable or disable the day/time alarm with the Enable Day/Time Alarm checkbox.

When Enable Day/Time Alarm is checked, you can select the day(s) of the week and the time of day (24h clock) that the alarm will trigger. You can also press the View/Edit Day/Time Alarm Message to display the message that will be sent to fax or SMS recipients when this alarm is triggered (see [“Editing Alarm Messages”](#) for more information on the format of alarm messages).

If enabled, the day/time alarm is automatically cleared once a notification message has been successfully sent to any appropriate recipients.

4.3.5. Comms Alarms

Select the "Comms Alarm" tab to configure the KDMON comms alarm triggers. Events occurring on the KDMON comms port (port 2) can be used to trigger alarms.



Only one type of comms alarm may be enabled at any time. This page allows you to select which type of comms alarm is enabled:

[Lost Comms Alarm](#) - triggers when no data is received on the comms port within a configured time;

[Received Message Alarm](#) - triggers when a message is received that matches a configured pattern;

[Modbus Alarm](#) - triggers when a value read from a configured Modbus slave device register matches a configured value;

Select which comms alarm is to be enabled and then press the **Configure Alarm Settings** button to configure the specific settings for the chosen alarm type.

This page also allows the KDMON comms port (port 2) communication parameters to be configured:

Baud rate values:

30 , 37.5 , 50 , 75 , 100 , 110 , 134.5 , 150 , 300 , 600 , 1200 , 2000 , 2400 , 3600 , 4800 , 7200 , 9600 , 19200 , 38400 , 57600 , 115200.

Bits/word values are 7 or 8.

Parity may be "none", "even" or "odd".

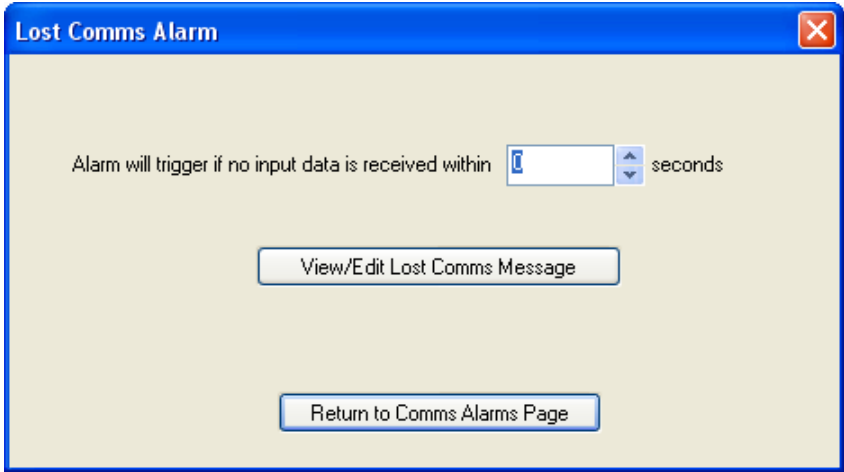
Stop Bits may be 1 or 2

RX and TX Xon/Xoff (receive and transmit software flow control) may both be enabled or disabled.

4.3.6. Lost Comms Alarm

This alarm triggers when no incoming data has been received on the KDMON comms port for the amount of time specified. This value must be in the range 1 to 65535 seconds.

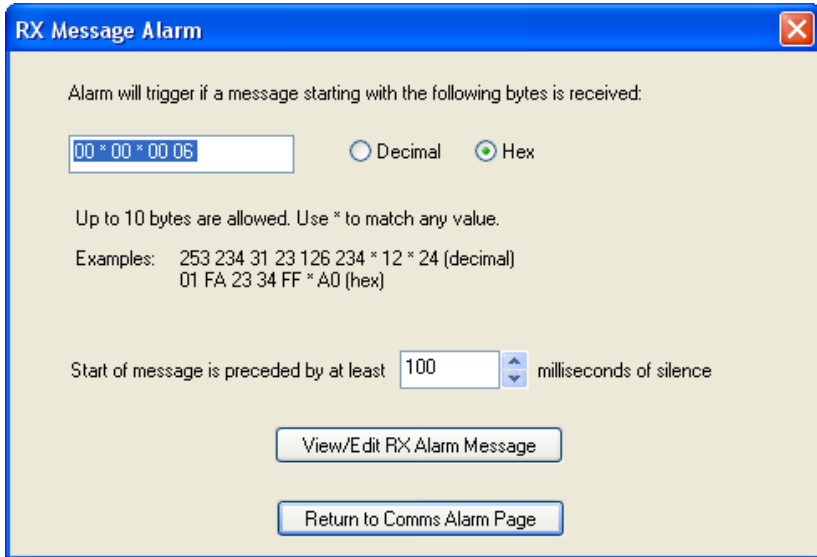
Note that for lost comms to be detected correctly, the Port 2 communication parameters (baud rate, bits/word, parity) must be configured correctly.



Press the View/Edit Lost Comms Message button to display the message that will be sent to fax or SMS recipients when this alarm is triggered (see [“Editing Alarm Messages”](#) for more information on the format of alarm messages).

4.3.7. Received (RX) Message Alarm

This alarm triggers when a message is received that starts with a particular sequence of (of up to 10) bytes.



You can configure a byte sequence pattern here using either hexadecimal or decimal numbers for the byte values (select Decimal or Hex first). A * can be used in your pattern to match any incoming single byte value.

The message start (or end of the previous message) is determined by a period of silence (no incoming data). You should configure this period (in milliseconds) depending on the equipment that will be sending these messages.

Press the View/Edit RX Alarm Message button to display the message that will be sent to fax or SMS recipients when this alarm is triggered (see ["Editing Alarm Messages"](#) for more information on the format of alarm messages).

4.3.8. Modbus Alarm

Enabling this alarm causes the KDMON (acting as a Modbus master) to poll a Modbus slave device (connected to the KDMON comms port) and read a 16 bit value from a specified Modbus register (using the specified Modbus function code to determine the register type).

Modbus Alarm

Read register number 5 function 03 from slave address 1 every 30 seconds

Bitwise AND result with 8000H (Specify a 16 bit value in hex or decimal Examples: 65535, 0xffff, FFFFh)

Alarm will trigger if result of AND operation is non-zero

When alarm triggers read and report register number 0 with function 03 multiply value by 1 (floating point value)

OR

When alarm triggers, read and report (as a single floating point value) two consecutive registers starting with register 10 with function 03

Enable Modbus error alarm if register cannot be read after 3 attempts

View/Edit Modbus Alarm Message View/Edit Modbus Error Alarm Message

Return to Comms Alarm Page

The value received from the slave is then masked (using a logical AND operation) with the 16 bit value configured on this page. If the result is non-zero then the alarm triggers.

When the alarm triggers, KDMON will perform an additional Modbus slave register read and will save the resulting value (which can be reported as part of the [alarm message](#)).

This additional register read can be performed in one of two ways:

- A single 16 bit register value will be read which will then be multiplied by a floating point value (configured here);

OR

- Two consecutive 16 bit values will be read to form a 32 bit floating point value.

Note that there is often confusion over Modbus register numbering with some manufacturers using the older Modicon 4xxxx notation and others using register numbers based from 1. The Modbus register numbers used with KDMON should be specified as a decimal number based from zero and with the Modbus function code determining the register type. For example to read Modbus holding register 40001, you would specify register 0 and function code 3 (read holding registers). Similarly, to read Modbus input register 30099, you would specify register 98 and function code 4 (read input registers).

In the event that the slave is unresponsive or returns a Modbus error code, the KDMON will retry the request a number of times (configured here). If the slave still does not respond successfully, a Modbus error alarm can be triggered.

Two alarm messages are associated with Modbus events:

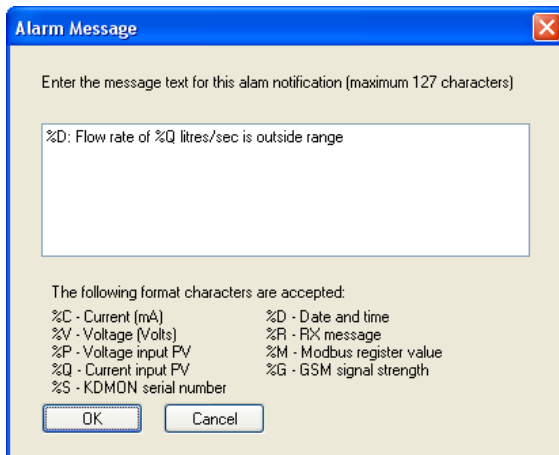
Press the **View/Edit Modbus Alarm Message** button to display the message that will be sent to fax or SMS recipients when the Modbus alarm is triggered.

Press the **View/Edit Modbus Error Alarm Message** button to display the message that will be sent to fax or SMS recipients when a Modbus Error condition alarm is triggered.

See "[Editing Alarm Messages](#)" for more information on the format of alarm messages.

4.3.9. Editing Alarm Messages

Each Alarm configuration tab has a button that allows you to edit the alarm message that will be sent for this type of alarm. Here you can compose, edit or view the alarm message that will be sent to fax or SMS recipients in the event of an alarm:



Each alarm type has its own unique message of up to 128 characters.

The alarm message can include the most recent voltage or current measurement from the KDMON ADC, the date and time (read from the KDMON real time clock), the value of the last received message on the comms port or a value read from a Modbus slave device register.

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Use the following special format characters in your message to achieve this:

%D Date and Time;

%V Voltage (V);

%C Current (mA);

%P Voltage Process Value

%Q Current Process Value

%R Received Message;

%M Value read from Modbus slave device register;

%S KDMON serial number

%G GSM signal strength

For example:

KDMON - %D, Voltage has exceeded range (%V).

will send a message like this:

KDMON - Fri 19/12/03 20:06:17, Voltage has exceeded range (-17.456V).

Note that the voltage and current measurements will be sampled (typically at 1 second intervals) even if the voltage and current alarms are disabled. These values can therefore be reported from any alarm message.

The message entry window in KDMONCFG limits the number of characters to 128. However, the maximum message size of 128 characters is enforced again after any variable fields have been expanded. This can result in truncation of messages actually received.

4.3.10. Resetting Alarms

Once a current, voltage or comms alarm has been triggered, that type of alarm cannot trigger again until it has been reset. This is to prevent an alarm condition causing endless notification messages to be sent.

Alarms can be reset by momentarily pressing the button on the KDMON front panel (do not hold this button down for more than a second as this will reset the KDMON).

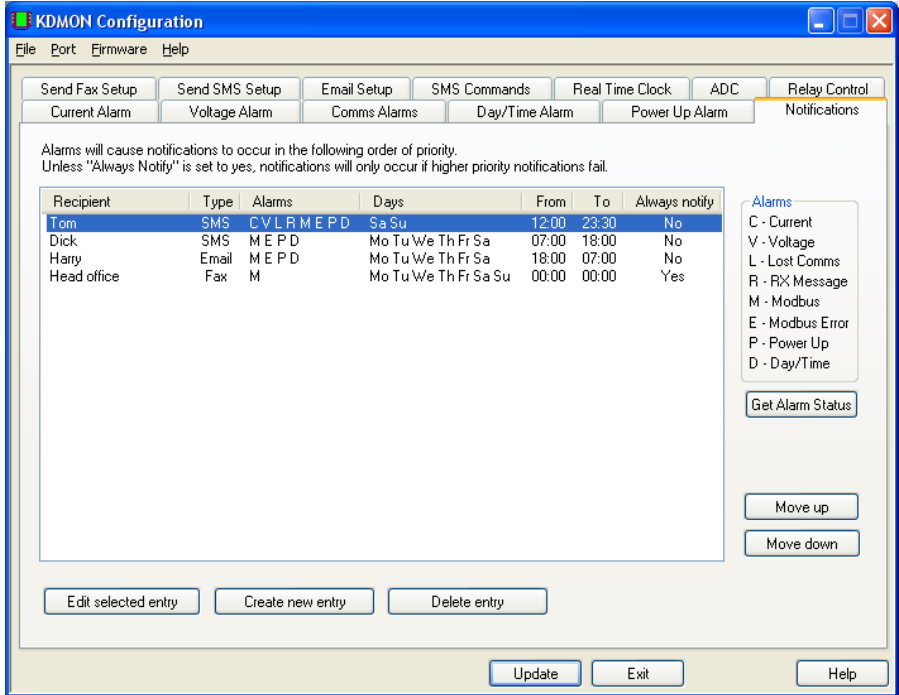
Alternatively, alarms can be reset remotely by sending an [SMS command message](#) to an SMS capable modem or phone connected to the KDMON config/modem port.

When any alarms are triggered the Alarm LED on the KDMON front panel will be on.

The power up alarm and day/time alarm automatically reset themselves once they have successfully sent a notification message.

4.4. *Configuring Alarm Notifications*

When an alarm event occurs, one or more recipients will receive a notification message by fax, email or SMS. Alarm notifications are configured by selecting the "Notifications" tab:



This page displays a list of notifications in order of their priority. Each notification indicates a recipient for a fax or SMS message, the types of alarms that the recipient should receive notification for and the days and times ranges when that notification should be used.

When any of the KDMON alarm types are triggered, the KDMON will work through its list of notifications in order of priority to find at least one entry that is configured to receive notification of this type of alarm.

The priority of a notification can be changed using the "move up" and "move down" buttons.

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Existing notifications can be modified by double clicking on the entry in the list or by selecting the notification and pressing the **Edit Selected Entry** button.

Similarly, a new notification can be created by pressing the **Create New Entry** button and notifications can be deleted using the **Delete Entry** button.

When a suitable notification is found, the recipient of that notification will be sent either an SMS message, and email or a fax (depending on how the recipient is configured).

Once a fax or SMS has been successfully sent, the KDMON will continue through the list of notifications looking for any other notifications that match are configured to receive this alarm. If any of these notifications have the **always notify** setting enabled, they will also be sent a fax or SMS message. Once a message has been successfully sent, lower priority notifications will not be used to send an alarm message unless they have the **always notify** setting enabled.

Should an attempt to send an SMS, email or a fax a recipient fail (after a number of retries), the KDMON will continue through the list of notifications looking for the next match. If the KDMON gets to the end of its list of notifications without having successfully sent a message, it restarts from the beginning of the list, and this is repeated indefinitely.

The number of retries for SMS, email and fax messages is configured on the [SMS setup](#) [Email Setup](#) and [Fax Setup](#) pages respectively.

See the

[KDMON Operation](#) Flow Chart for more details of the notification logic.

Pressing the **Get Alarm Status** button will read the current state of alarms from the KDMON. Any alarms that are triggered will be shown in **red** in the list of alarms shown above the button.

4.4.1. Adding / Editing Notifications and Recipients

A **notification** indicates which recipient will receive a message in the event of an alarm, which alarm types should be sent to this recipient and on which days and times this recipient should receive these messages.

A **recipient** comprises a name, a phone number and indicates whether the number is for fax or SMS.

Add a new notification entry by pressing the "Create new entry" button on the "Notifications" page. When adding a notification, you first add a recipient by entering an appropriate name (for example "Fred Smith Mobile" or "Head Office Fax") and the phone number. Select the type of recipient: fax or SMS.

Alternatively, you can select an existing recipient from the drop down list and double click on it (or press the Edit Selected Entry button) to display it:

Note that for SMS numbers a '+' should be used to introduce an international number whereas for fax, the appropriate numeric prefix should be used.

The "Availability" section determines when this notification will be used. Select the days of the week and a time range. Time ranges can be up to 24 hours. This means that a time range can start on one day of the week and continue overnight into the next day. In this case, the days selected correspond to the start of the time range. For example if you select Wed and a time range of from 21:00 to 7:00, this notification will be valid from 21:00 on Wednesday until 7:00 on Thursday (even though Thu is not selected).

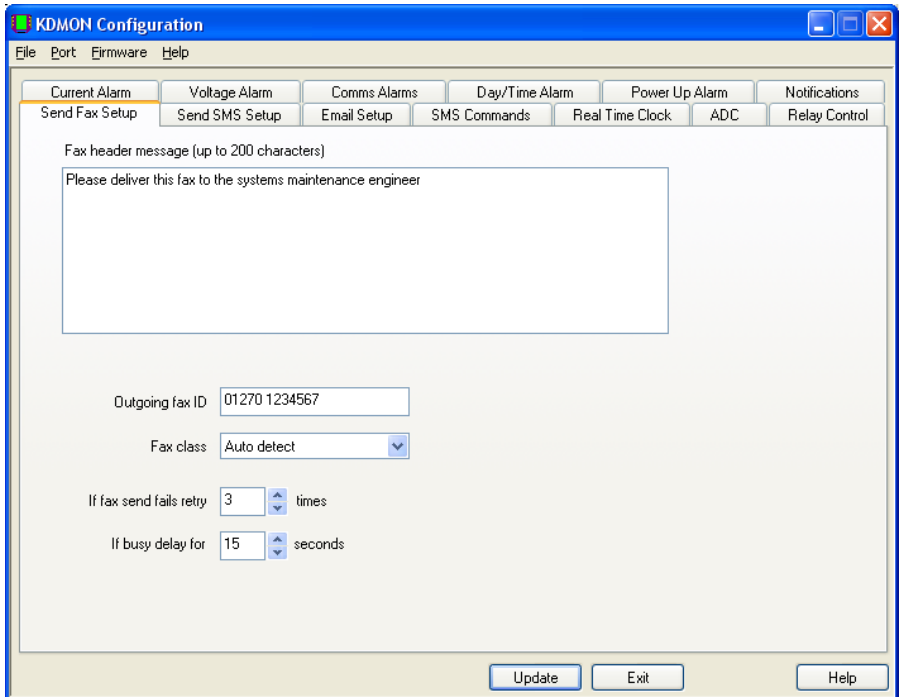
The "Alarms" section determines which alarm types this notification is valid for.

The "Priority" indicates whether this notification should be used even if higher priority notifications have already been successfully sent for this alarm. The setting for this option defaults to **Always Notify**, which is the recommended setting because in most cases it is not possible to safely determine whether a notification has (or has not) been delivered. Almost the only scenario where non-delivery is clear is with FAX, where the transmission will fail if the fax machine is offline, out of paper, etc.

Multiple notifications can use the same recipients. This allows a great deal of flexibility. For example you can creating a high priority notification that causes a particular employee to receive certain types of alarm messages within the days/times when they are on duty. At other times another employee might be configured, with another notification to receive these messages. However, should the notification to the appropriate "on duty" employee fail, lower priority notifications can be added to ensure that either of the employees will still receive an emergency message during their "off duty" hours.

4.4.2. Fax Setup

Select the "Send Fax Setup" tab to configure the KDMON for sending faxes:



This page allows a Fax Header Message to be entered (for example to indicate where the fax should be delivered and where it is from). This message will appear on the resulting fax before the [alarm message](#) (that is configured for the particular alarm that has triggered).

The Outgoing Fax ID is normally the number that the fax is being sent from. Some fax machines display or log this ID when a fax is received. However, this number will not

normally appear on the received fax unless the receiving fax machine is configured to print it.

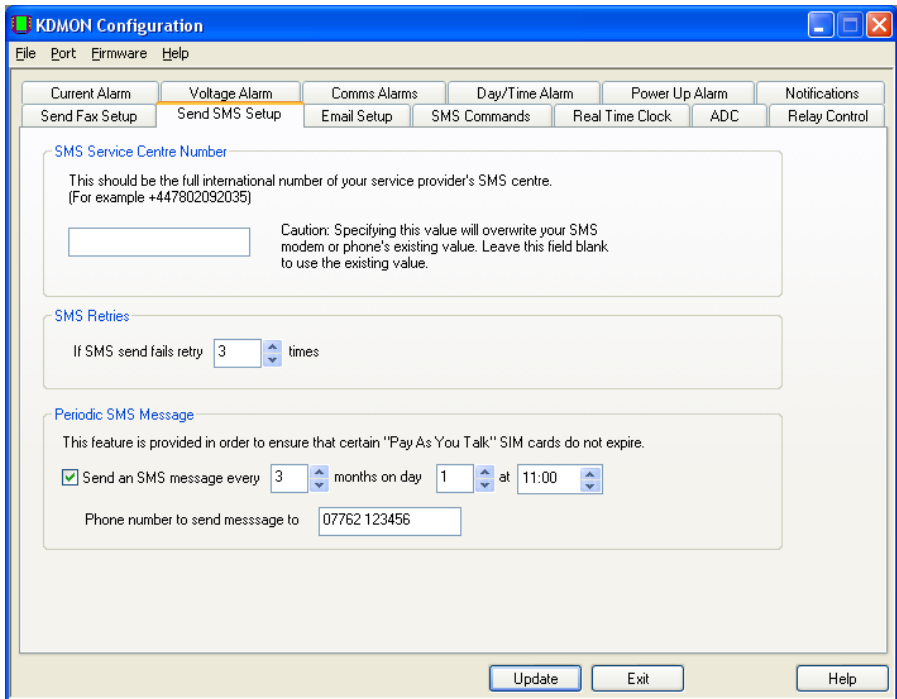
The Fax Class should normally be set to "Auto Detect". However, some fax modems may be more reliable if when using specific fax class. KDMON supports both fax classes 1 and 2 (but not the little used class 2.0)

If fax send fails retry - this setting determines how many times the KDMON will attempt to send the fax to each notification before moving on to the next notification in the list.

If busy delay for - this setting allows KDMON to wait for a number of seconds before retrying should the fax modem indicate that the line is busy.

4.4.3. SMS Setup

Select the "Send SMS Setup" tab to configure the KDMON for sending faxes:



SMS service centre number - This is the full international number (starting with a '+') for your cellular phone service provider's SMS centre.

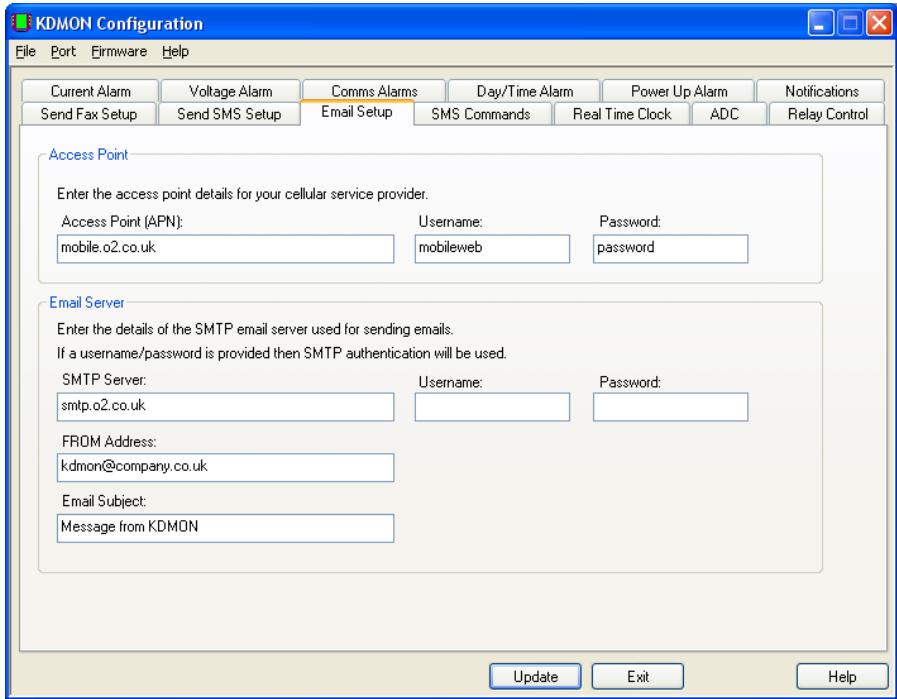
Caution: Entering a phone number here will overwrite any existing SMS service centre number stored by the SMS modem or phone SIM card. If in any doubt, leave this field blank to use the existing value.

SMS retries - This field determines how many times the KDMON should retry sending an SMS message to a particular notification in the event of failure. After this number of attempts, the KDMON will move on to the next matching notification in its list.

Periodic SMS Message - This feature is provided in order to keep most "Pay As You Go" SIM cards from expiring. Most cards expire if an outgoing message or call is not made within a given time period; usually 3 or 6 months. If you enable this feature, you can configure a message to be sent to a given number every n months at a particular date and time. It is acceptable for the KDMON to send the message to its own number, as this will create the required chargeable event, and the KDMON discards any unrecognised received messages.

4.4.4. Email Setup

Select the "Send Email Setup" tab to configure the KDMON for sending email:



Sending email requires the use of a specific modem: Cinterion MC52i or MC55i.

Access Point – This determines how the modem should connect to the Internet. These details (APN, username and password) are specific to each cellular service provider but will typically be the same for all users of the same network (although may be different for contract and PAYG services).

Email Server – Here you should enter the details of the email (SMTP) gateway that you want to use to send email. This may be a service provided by your cellular service provider, Internet service provider or may be your own corporate email server. Typically, if it is not provided as part of the cellular service, you will need to provide a valid username and password for SMTP authentication.

From address – This is the email address that you want the email from KDMON to appear to be from. Note that some Internet service providers (BT for example) will only allow email to be sent using their SMTP servers if the email has a from addresses that they have provided or that has been configured for use with their account.

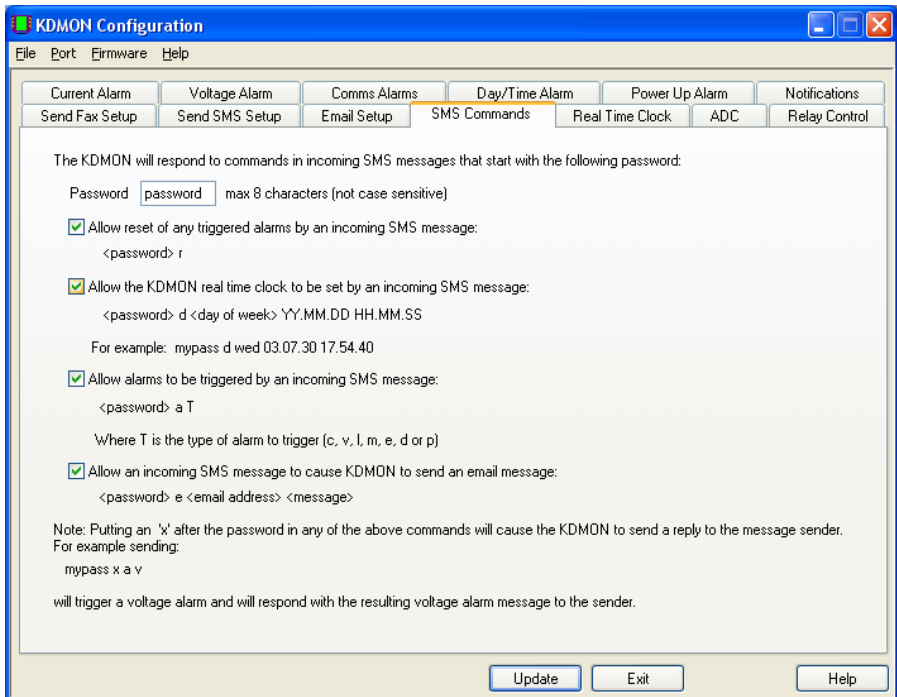
Email subject – Any short text can be used here (up to 128 characters). It will be used as the subject line for all messages sent by KDMON.

When using email, the destination (recipient) email address should be chosen with care because many email services use spam filters with unpredictable behaviour.

4.5. Sending Messages to KDMON

As well as sending SMS messages via an SMS modem or suitable cellular phone, the KDMON can also receive SMS messages. These messages can be used remotely to reset any triggered alarms, to set the KDMON's real time clock, and for other purposes.

Select the "SMS Commands" tab to configure this feature:



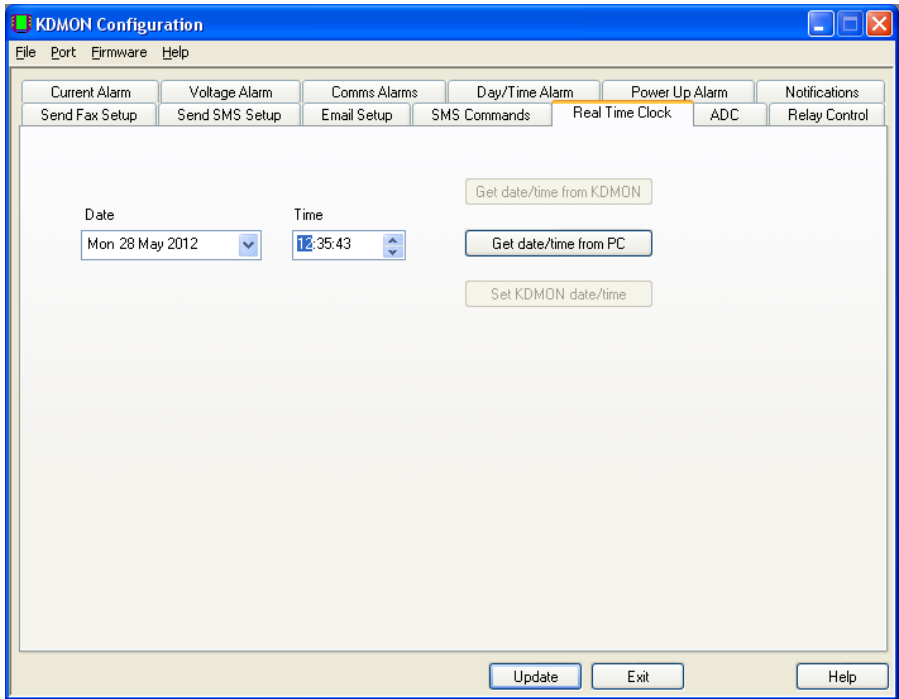
To use this feature, you must set a password. KDMON will only respond to incoming SMS messages that start with this password. For convenience, this password is not case sensitive.

You can individually enable or disable any of the remote SMS command functions.

The final SMS command is effectively an SMS to Email gateway. Note that only single messages are supported i.e. the incoming message must be shorter than 160 characters. The SMS protocol supports chained messages but these are not supported.

4.6. *Setting the KDMON Real Time Clock*

The KDMON real time clock can be read or set by selecting the "Real Time Clock" tab in the KDMON configuration program:



Use the Get Date/Time From KDMON button to read the current date and time from the KDMON real time clock.

Note that the Get Date/Time From KDMON and Set KDMON date and time functions may report "No response from KDMON" if the KDMON is busy trying to perform a fax or SMS operation. Either wait a few seconds or reset the alarms (by pressing the button on the KDMON front panel) before trying again.

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You can read the current date and time from the PC in the date and time controls using the Get Date/Time From PC button or you can edit the date and time shown in these controls.

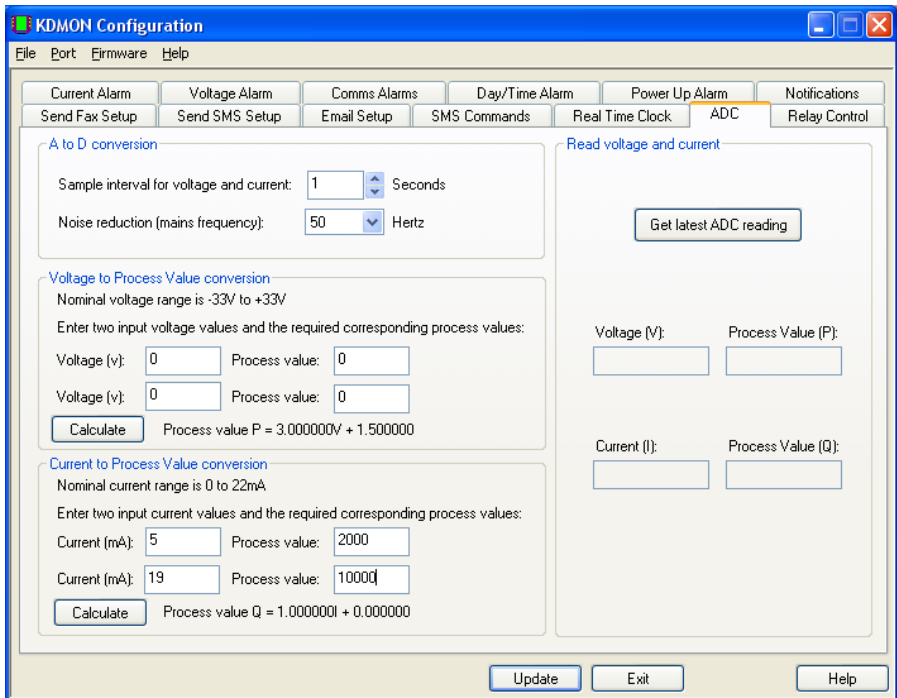
Use the Set KDMON date and time button to write the values shown in the controls to the KDMON real time clock.

It is also possible to set the KDMON real time clock remotely by sending the KDMON an SMS command (see [Sending Messages to KDMON](#) for more details).

Note that the Get Date/Time From KDMON and Set KDMON Date and Time functions may report "No response from KDMON" if the KDMON is busy trying to perform a fax or SMS operation. Either wait a few seconds or reset the alarms (by pressing the button on the KDMON front panel) before trying again.

4.7. *Configuring the A to D Converter*

The KDMON A to D Converter (ADC) can be configured by selecting the "ADC" tab:



Sample interval for voltage and current - This determines how frequently voltage and current measurements will be taken.

Noise reduction (mains frequency) - At the sample interval, the KDMON will read a large number of samples from the ADC channels, for the period of this setting, and calculate the average value. For maximum elimination of mains electrical noise, this period is set to 17ms for 60Hz mains and 20ms for 50Hz mains.

Process Values - The process values P and Q may be used to represent any linear physical properties that are being measured by the voltage and current inputs of the ADC. KDMON can be configured to convert the voltage and current readings into the required process values. For example, if a flow-rate sensor draws 5mA for a flow rate of 2000ml per second and 19mA for a flow-rate of 10000ml per second. By using these two points to calculate the linear relationship between the flow rate and the current drawn, KDMON can trigger alarms and report messages using values that will have more meaning to the user than simply reporting the mA values. The screenshot above relates to this example.

Voltage to Process Value conversion – These values determine how the voltage value sampled from the ADC will be converted to the process value P that may be used to trigger the voltage alarm. Enter two ADC voltage values (in volts) and the corresponding required values of P and press the Calculate button. A coefficient and constant are calculated that will be used to calculate the value P according to the formula $P = mv+c$ (where v is the voltage sampled from the ADC, m is the coefficient and c is the constant). Note that these values will only be stored in the KDMON configuration when the Update button is pressed.

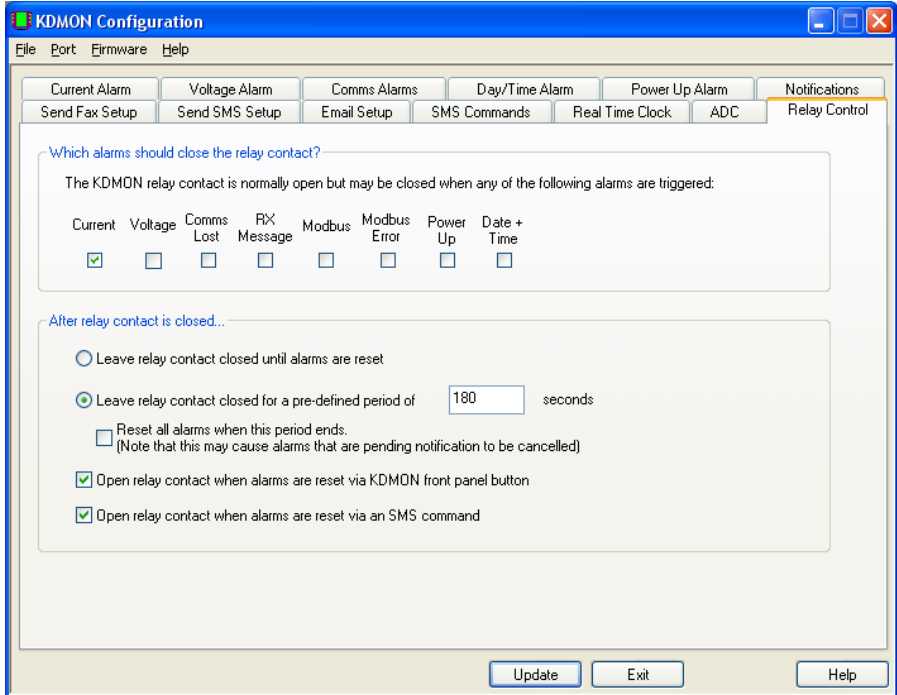
Current to Process Value conversion – These values determine how the drawn current value sampled from the ADC will be converted to the process value Q that may be used to trigger the current alarm. Enter two ADC current values (in mA) and the corresponding required values of Q and press the Calculate button. A coefficient and constant are calculated that will be used to calculate the value Q according to the formula $Q = mi+c$ (where i is the current sampled from the ADC, m is the coefficient and c is the constant). Note that these values will only be stored in the KDMON configuration when the Update button is pressed.

Press the Get latest ADC reading to read the most recent voltage and current values from the KDMON and to show the resulting process values as calculated by KDMON. Note that if Update has not yet been pressed, the resulting process values may not be calculated using the conversion values currently shown on this page.

Note that the Get latest ADC reading function may report "No response from KDMON" if the KDMON is busy trying to perform a fax, email or SMS operation. Either wait a few seconds or reset the alarms (by pressing the button on the KDMON front panel) before trying again.

4.8. Configuring the Relay Operation

The KDMON relay option may be configured by selecting the “Relay Control” tab:



The KDMON relay can be configured to be closed whenever any of the KDMON alarms are triggered.

This feature can be used in conjunction with the SMS “a” command (see section 4.5 - Sending Messages to KDMON) in order to provide a remote SMS message controlled relay by forcing one of the KDMON alarm types to trigger. As any of the alarm types may be chosen for this “virtual” alarm, you may want to choose an alarm type that is not already being used to monitor and generate notifications from a physical input (unless you require the configured recipients to be notified when the relay has been remotely triggered in this manner).

Once the relay contact has been closed, there are a number of options that control when and how it will be opened. These options allow the relay to be left closed until the alarm condition is reset (either by pressing the KDMON front panel button or by sending an SMS reset message).

Additionally, the relay can be automatically re-opened after a pre-defined time period has elapsed. For example, a temperature sensor could be employed to trigger a current alarm which in turn could be used to close the relay to drive a cooling fan for a pre-defined period.

At the end of this pre-defined period, the “Reset all alarms when this period ends” option allows for the KDMON alarms to be reset in order that they may re-trigger when the trigger condition reoccurs. Note that if the trigger condition is still present when the alarms are reset, the alarm may immediately re-trigger and close the relay again.

The “Reset all alarms when this period ends” option should be used with caution if the KDMON is configured to send notification messages via SMS, email or fax. In this case, if the pre-defined relay close period is less than a few minutes, resetting the alarms may cause any pending notifications to be cancelled.

5. Troubleshooting

KDMON Power Up Problems

With a 24V power input, there should be an output of approximately 20-21V between pin 4 and pin 6 of the 6-way Port 2 terminal block. Pin 4 is the positive terminal in this case.

The KDMON internal power supply will fail to start if the supply voltage rises from zero to the internal power supply startup voltage (approximately 4V) very slowly. See the Power Requirements section for details.

If after power-up the ALARM LED enters a repeating pattern of rapid blinks followed by a longer pause, this indicates that a hardware fault has been detected by the KDMON power-up test firmware. This fault requires a return to the factory.

KDMONCFG unable to connect

Check the COM port is correct. If using a USB to RS232 converter, look in Control Panel / Devices / COM&LPT Ports to see what COM port number has been allocated.

This problem will appear occasionally because the KDMON uses the RS232 port for periodic modem comms and checks for KDMONCFG commands only in between these. However, it does not do modem comms during the first minute after power-up and this is therefore the best time to start up KDMONCFG.

SMS notifications not working

Check there is a GSM signal. A quick press of the button causes the ALARM LED to blink 1-6 times and this indicates the signal strength. At least 1 blink (level 1) is required for SMS to work. Level 1 is marginal however and level 2 is strongly preferred.

Check that the SIM card works in a normal GSM phone.

Email notifications not working

Check there is a good GSM signal (see above) of at least level 2.

Check that the SIM card works for an internet (web or email) function in a mobile phone.

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Check the APN is correct for that particular SIM card: contact the network provider and ask what APN should be used with a SIM card on that particular mobile number.

Check the SMTP server is correctly configured, and test it from another device. If it is the mobile network's SMTP server, it may require the From: address to be a specific value for the network to accept the email for transmission.

In cases which are very rare in Europe, there may be a GSM signal but no GPRS support.

The Cinterion modems do not support data where 3G is available but GPRS is not.

Fax notifications not working

Check there is a good GSM signal (see above) of at least level 3.

Most networks do not support fax. In the UK, only Vodafone and Virgin do (6/2011).

Modbus Alarm Notification problems

Check for the standard RS485 issues i.e. A/B signal swap. The serial comms parameters also need to be correctly set.

For optimum noise immunity, the KDMON comms ground (pin 4 on Port 2) needs to be connected to the comms ground terminal on the MODBUS device. Port 2 is isolated from Port 1 and from the power supply so there is no risk of creating ground loops – provided that the other Port 2 functions (voltage and current) are not separately grounded.

Ensure that you have configured the Modbus register and read function used to trigger the alarm correctly. Different Modbus equipment manufacturers may use different conventions for Modbus register numbering (see section 4.3.8 for more details).

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