IQAN-XA2
Instruction book

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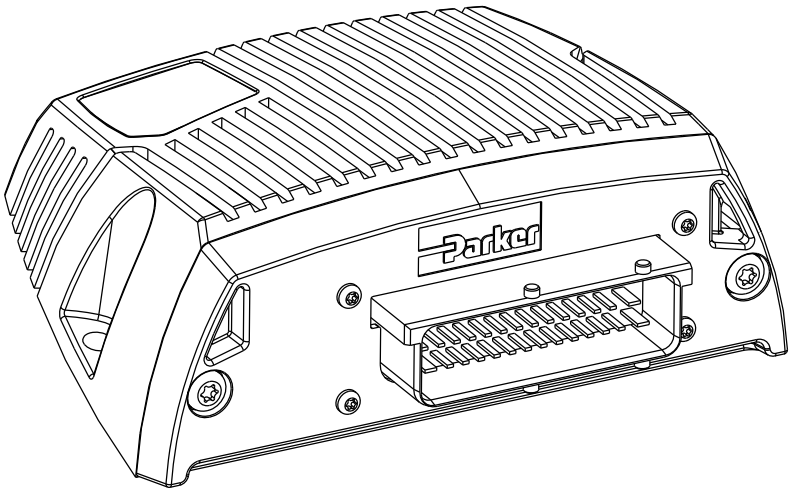

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1 Introduction

These instructions are to be used as a reference tool for the vehicle manufacturer’s design, production, and service personnel.
The user of these instructions should have basic knowledge in the handling of electronic equipment.

Warnings

Sections marked with a symbol in the left margin, must be read and understood by everyone using the system, carrying out service work, or making changes to hardware and software.
The different symbols used in this manual are defined below.

WARNING
Sections labeled *WARNING* with a caution symbol in the left margin, indicate that a hazardous situation exists. We use warnings, marked with the warning symbol, in two ways.

- As a strong recommendation about work practices when using the product in the machine (e.g. routines when updating an application). This use is common to the term 'hazardous situation', that a person is exposed to a hazard.
- As a way of pointing out important information for the machine designer that in some way relates to safety. This includes the design of the physical machine, and also the application program being developed for the control system.

Not all document sections that contain information about safety are marked with a warning symbol (there would be warnings everywhere). Failure to comply with the recommendations can cause unintentional, and unexpected behavior of the control system. This can potentially cause death, serious injury or property damage.

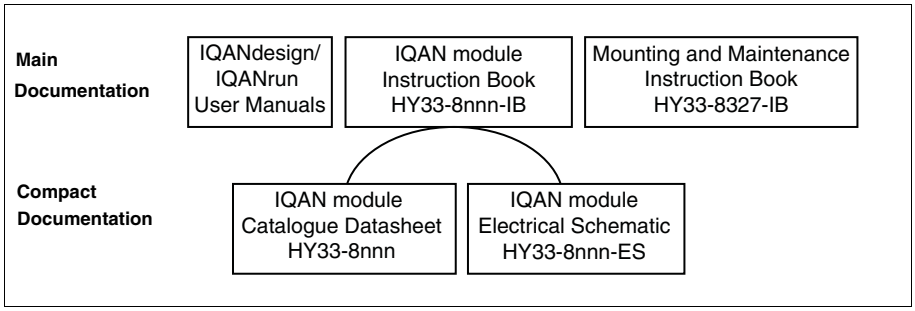
NOTICE
Sections labeled *NOTICE* with a notice symbol in the left margin, indicate there is important information about the product. Ignoring this could result in less than optimal performance, or damage to the product.
Contact the manufacturer if there is anything you are not sure about or if you have any questions regarding the product and its handling or maintenance.
The term "manufacturer" refers to Parker Hannifin Corporation.

Overview of relevant documentation

The following publications are relevant for users of this product.

The main documentation contains information that is not found elsewhere.

The additional documentation contains product information in a compact format, for details on the information found in those documents, consult this manual.



The IQAN module documentation system.

2 Precautions

Work on the hydraulics control electronics may only be carried out by trained personnel who are well-acquainted with the control system, the machine and its safety regulations.

WARNING
Make sure that you have sufficient knowledge before designing, modifiying or servicing the control system.
Read the relevant sections of this document before conducting any work on the control system.

WARNING
This product is not field repairable.

NOTICE
As much as possible of the welding work on the chassis should be done before the installation of the system. If welding has to be done afterwards, the electrical connections on the system must be disconnected from other equipment. The negative cable must always be disconnected from the battery before disconnecting the positive cable. The ground wire of the welder shall be positioned as close as possible to the place of the welding. The cables on the welding unit shall never be placed near the electrical wires of the control system.

Read This

Design of control system

WARNING
Risk of injury may be introduced by design of control system!
This product is designed to control hydraulic outputs. The control application must be designed using basic safety principles so that unintentional movement is avoided.
The machine must be equipped with an emergency stop that stops all movement. Please refer to section "Supply voltage".

Before you start

Read this document.
Read the IQANdesign software user manual section on 'application safety'.

Start-up, maintenance, and diagnostics

For all personnel carrying out installation, commissioning, maintenance or troubleshooting.

WARNING
Work on the hydraulics control electronics may only be carried out by trained personnel who are well-acquainted with the control system, the machine and its safety regulations.

Before you start,
Read section "Start-up".

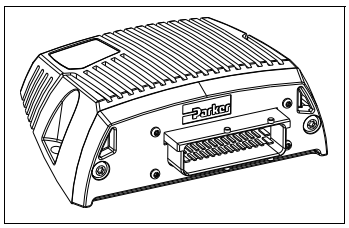
Additional information for service
Mounting and maintenance instruction book.

Additional information for diagnosing the system
Read section "System diagnostics", and see "Appendix B", in this document.
Use the IQANrun software user manual as a reference.

3 Product description

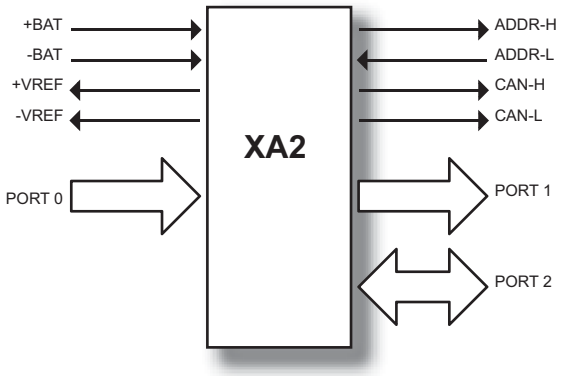
IQAN-XA2

The IQAN-XA2 is a flexible expansion module designed for controlling hydraulic systems in vehicles and machinery, using 12/24 Vdc power supply.



The IQAN-XA2 module.

I/O overview



Inputs

The IQAN-XA2 module has eight (8) *voltage inputs* VIN-A thru VIN-H for connection of 0-5 Vdc signals. The inputs VIN-E thru VIN-H are multi-purpose and for flexibility may be configured in other ways. The two input pins VIN-E and VIN-G can be configured as *frequency inputs* for measuring frequency. The group of four pins VIN-E thru VIN-H can be configured as *quadrature* or *directional inputs* for measuring directional frequency. *Voltage inputs, frequency inputs, quadrature inputs* and *directional inputs* share positions, see below.

(8) Voltage inputs VIN-A, VIN-B, VIN-C, VIN-D.....VIN-H

or

(6) Voltage inputs VIN-A thru VIN-D,VIN-F and VIN-H.
(2) Frequency inputs FIN-A and FIN-B use positions VIN-E and VIN-G.

or

(4) Voltage inputs VIN-A thru VIN-D. (2) Quadrature or Directional inputs DFIN-A+/DFIN-A- and DFIN-B+/DFIN-B- use positions VIN-E thru VIN-H.

or

(8) Digital inputs DIN-A, DIN-B.....DIN-H use positions VIN-A thru VIN-H.

Proportional outputs

The XA2 module has six (6) double *proportional outputs* for controlling proportional valves. These outputs can control six bi-directional valve sections or six single solenoid devices (ie. proportional cartridge valves). The proportional outputs can be used in two different modes. Either *Current mode* or *PWM mode* signals can be selected and the parameters configured using IQAN software.

In both modes, the output applies battery voltage minus voltage drop during the on-phase. The difference between COUT and PWMOUT is that for COUT there is closed loop control of current, and for PWMOUT there is open control of current by commanding a *modulation ratio* (MR%).

For flexibility these outputs may also be configured as up to six (6) *on/off outputs* and up to twelve (12) *on/off intputs*. The proportional outputs, on/off outputs and on/off inputs share positions, see below.

(6) double proportional outputs COUT-A thru COUT-F
or
(6) on/off outputs DOUT-G thru DOUT-L, each pair of return pins may then be used as (2) on/off inputs, (12) total, DIN-I thru DIN-T.

In order to increase the performance of proportional outputs when controlling proportional valves, the *dither frequency* can be adjusted.

High power On/Off outputs

The XA2 module has six (6) *on/off outputs* that are high-side power outputs. These outputs may not be configured as proportional, see below.

(6) On/off outputs DOUT-A thru DOUT-F

CAN related functions

The master uses the CAN-bus (CAN = Controller Area Network) to communicate with the modules. The CAN-bus is a robust communication protocol that is widely used and well proven within the automotive industry.

4 Safety

Internal diagnostics

The module performs a number of self-checks that improve safety. Checks include monitoring of voltage supplies, checksums on memory and a watchdog that monitors software execution. The module is using a real time operating system which supervises software execution.

If a critical error is detected, the module is stopped, with CAN-bus and outputs off.

CAN-bus interruption

The IQAN modules communicate on a CAN-bus. Both the master module and expansion modules check for any interruptions in CAN-bus communication. If an error occurs the master will use zero or an application defined error value for the module inputs, and the module outputs will be off.

The error will be presented on the master/display module, if there is one, and with a related blink code on the IQAN module status LEDs, see Appendix B.

Current check

For modules with proportional outputs, when used in current mode a current check is performed. If an error is detected, this will be indicated on the master module, and the output will shut off.

The module can detect open-circuit, short-circuit to +BAT/-BAT or short-circuit to other proportional output and return pins.

Emergency stop

WARNING

Risk of injury!

The emergency stop must disconnect the power supply to the module; do not connect the emergency stop as a signal input only.

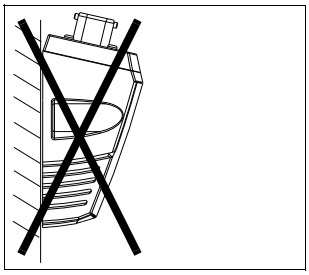
The emergency stop must be installed so that the risk of reverse feed of the module is avoided, see section "Supply voltage".

5 Mounting

Mounting the module

The IQAN module should be mounted according to the following instructions:

- Locate the module eliminating the risk for the cabling to be folded, crushed or damaged in any way. Ensure the cabling cannot pull, twist or induce sideload on the connector.
- Locate the module so that severe physical impact is avoided, e.g impact from falling objects or the module being used as a step.
- Locate the module so that air can circulat to eliminate excess heat. Ensure that no external heat, e.g. from the engine or heater, is transferred to the module.
- Locate the module to protect it from high pressure washing or similar.
- Locate the module so that the cable connector is facing down .
- Locate the module so that the LEDs are visible.



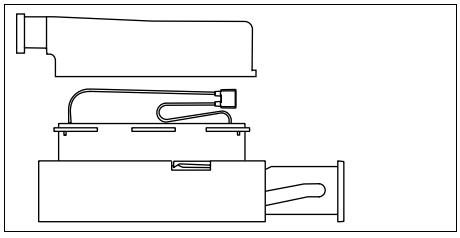
Non approved placing.

NOTICE

The IQAN module must not be placed in any marine related or similar continuously damp, salt-spray environment without external protection.

Assembling of the ID-Tag

The ID-Tag will be placed in the connector in order to address/ terminate the module. For IQAN master modules, the use of an ID-tag is application dependant. All IQAN expansion modules require an ID-tag, ref section "Addressing/terminating".
The ID-Tag will be mounted under the connector casing. Bend the ID-Tag’s wires toward the opposite side of where the other wires enter the connector.

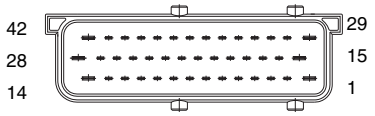


Assembling of the Id-Tag.

6 Installation

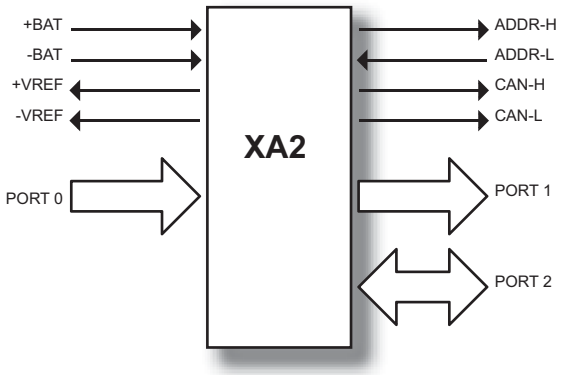
Connector C1

Connector kit	Parker no. 5031063	
Housing	Amp no. 1-963226-1	
Casing	Amp no. 0-965643-1	
Plane sealing, 42 p	installed in module	
Pin types*	Amp no. 963711-2 (MT)	Amp no. 929938-1 (JPT)
Cables	0,75-1,0 mm² (MT)	1,5-2,5 mm² (JPT)
Seals	Amp no. 963530-1 (MT)	Amp no. 828905-1 (JPT)
Plugs (empty pos.)	Amp no. 963531-1 (MT)	Amp no. 828922 (JPT)
IQAN crimping tool references	Blue handle, pos. A use blue extraction tool	Red handle, pos. B use yellow extraction tool
IQAN tool kit	Parker no. 5031061	



*= The connector contains two types of terminals; MT (Micro Timer) and JPT (Junior Power Timer).

Connector pin assignments



Logical Symbol	Pin No.	(I)nput or (O)utput	Function description and/or Signal name(s)
+BAT	28	-	Power supply, positive.
-BAT	15	-	Power supply, negative ground
+VREF	42	-	Voltage reference for external sensors. Sourcing +5V.
-VREF	29	-	Voltage reference for external sensors. Return (0V).
ADDR-H	1	-	High side to address tag. Sourcing +5V.
ADDR-L	14	-	Low side to address tag. Return (0V).
CAN-H	26 27	- -	CAN high voltage bus line, will be HIGH in dominant state.
CAN-L	40 41	- -	CAN low voltage bus line, will be LOW in dominant state.

Logical Symbol	Pin No.	(I)nput or (O)utput	Function description and/or Signal name(s)			
P0			P0 is an 8 pin input port with alternate functions on four inputs.			
			VIN	**DIN**	**DFIN**	**FIN**
		I				
P0.0	10	I	VIN-A	DIN-A	-	-
P0.1	11	I	VIN-B	DIN-B	-	-
P0.2	12	I	VIN-C	DIN-C	-	-
P0.3	13	I	VIN-D	DIN-D	-	-
P0.4	24	I	VIN-E	DIN-E	DFIN-A+	FIN-A
P0.5	25	I	VIN-F	DIN-F	DFIN-A-	-
P0.6	38	I	VIN-G	DIN-G	DFIN-B+	FIN-B
P0.7	39		VIN-H	DIN-H	DFIN-B-	-
			Note: DIN-A to DIN-H have high impedance inputs (62K Ohm).			
P1			P1 is an 6 pin output port.			
			DOUT			
P1.0	8	O	DOUT-A			
P1.1	9	O	DOUT-B			
P1.2	22	O	DOUT-C			
P1.3	23	O	DOUT-D			
P1.4	36	O	DOUT-E			
P1.5	37	O	DOUT-F			
P2			P2 is an 18 pin input/output port with alternative functions.			
			COUT	**PWMOUT**	**DIN**	**DOUT**
P2.0	2	O	COUT-A	PWMOUT-A	-	DOUT-G
P2.1	16	O/I	CRET-A+	PWMRET-A+	DIN-I	-
P2.2	30	O/I	CRET-A-	PWMRET-A-	DIN-J	-
P2.3	3	O	COUT-B	PWMOUT-B	-	DOUT-H
P2.4	17	O/I	CRET-B+	PWMRET-B+	DIN-K	-
P2.5	31	O/I	CRET-B-	PWMRET-B-	DIN-L	-
P2.6	4	O	COUT-C	PWMOUT-C	-	DOUT-I
P2.7	18	O/I	CRET-C+	PWMRET-C+	DIN-M	-
P2.8	32	O/I	CRET-C-	PWMRET-C-	DIN-N	-
P2.9	5	O	COUT-D	PWMOUT-D	-	DOUT-J
P2.10	19	O/I	CRET-D+	PWMRET-D+	DIN-O	-
P2.11	33	O/I	CRET-D-	PWMRET-D-	DIN-P	-
P2.12	6	O	COUT-E	PWMOUT-E	-	DOUT-K
P2.13	20	O/I	CRET-E+	PWMRET-E+	DIN-Q	-
P2.14	34	O/I	CRET-E-	PWMRET-E-	DIN-R	-
P2.15	7	O	COUT-F	PWMOUT-F	-	DOUT-L
P2.16	21	O/I	CRET-F+	PWMRET-F+	DIN-S	-
P2.17	35	O/I	CRET-F-	PWMRET-F-	DIN-T	-
			Notes: *If a COUT block (COUT-x, CRET-x+, CRET-x-) is used, all three pins are configured for COUT.* *If a PWMOUT block (PWMOUT-x, PWMRET-x+, PWMRET-x-) is used, all three pins are configured for PWMOUT.* *If a DIN-x or DOUT-x is used in a block (COUT-x, CRET-x+, CRET-x-), all three pins are configured as corresponding DIN-x and DOUT-x.* *DIN-I to DIN-T are equipped with clamping diode, risk for 'backending'.See section "Connecting switches to digital inputs".*			

Shaded positions are Junior Power Timer pins. Unshaded positions are Micro Timer II pins. See above for wire, seal, pin number and crimping tool information. The IQAN tool kit is found in the "IQAN accessories" datasheet.

Supply voltage

Before any installation of the IQAN system can take place, make sure the ignition lock is turned off and the battery is disconnected.

Emergency stop

Make sure an *Emergency Stop* disconnecting the power supply, is easily accessible at any time. The figure below shows how to connect the emergency stop.

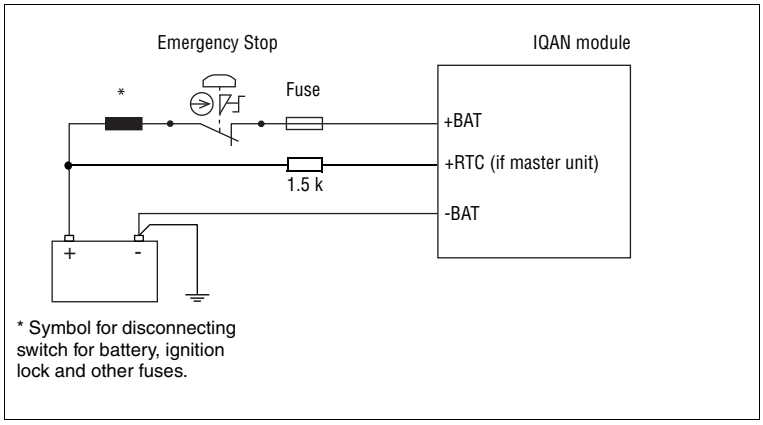
Connecting of Supply Voltage

The supply voltage, should be within the operating interval, see Appendix A. Connect the supply voltage to +BAT and -BAT. Protect the module by using a fuse. For recommended fuse level, see Appendix A.

RTC supply

IQAN master modules have a clock that is used for date/time stamping when logging data. The *real time clock*, +RTC, requires a separate positive power connection. Connect the supply voltage to +RTC through a 1.5K ohm resistor. The resistor should be as close to the battery as possible for safety.
IQAN expansion modules do not have +RTC.

WARNING
Risk of injury!
To reduce the risk for uncontrolled supply of an IQAN master module, i.e., a short circuit between the +RTC cable and +BAT, a resistor must be connected between the battery and the +RTC input. This is important as this line is not controlled by an emergency stop.
The resistor should be placed close to the battery, as the ’protected’ part is the cable between the resistor and the unit.
This will prevent the +RTC wire from powering up the unit if shorted to +BAT.



Connecting the emergency stop and voltage supply.

NOTICE
Do not use the chassis as the negative terminal.

Polarity reversal

The module is protected against power supply polarity reversal and over-voltage, provided an external fuse is being used.
If this fuse is not used, polarity reversal can damage the unit.

Addressing/terminating

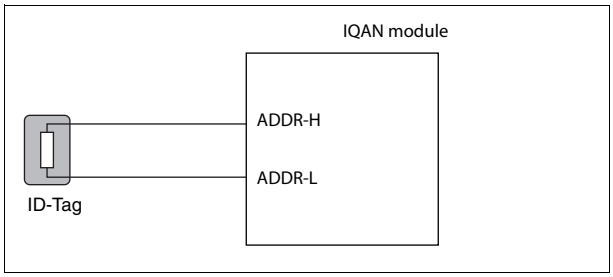
Addressing

Each IQAN expansion module will have a specific address, enabling the *master module* to communicate with the modules through the CAN-bus. When operating, the system distinguishes between different modules by first verifying the module type and secondly, through the modules having unique addresses.

EXAMPLE

If having an expansion module with address 0, the system will denote this one as [module type]-A0, The letter "A" in the example refers to CAN-bus A.

The maximum number of similar modules in a system is four or eight depending on the master module, denoted in the first case as addresses 0, 1, 2, 3 respectively. In order to assign any IQAN module a unique CAN-address, an *ID-Tag* will have to be connected to the positions ADDR-H and ADDR-L.



Connecting of Id-Tag.

Terminating

To eliminate interference in the communications through the CAN-bus, the CAN-bus must be terminated at both ends. By default, if no ID-tag is installed in an IQAN master, it will be terminated internally to be the Bus master and will have no special configuration.

When an IQAN expansion module is located at the end of the CAN-bus, then you would use an ID-tag having a combined addressing and terminating function. This is denoted with a "T" for terminating, after the appropriate address such as; 0T, 1T, 2T... etc. In the application, the same address value as the non-terminated ID-Tag with equivalent number will be transferred to the application.

Selecting appropriate ID-Tag

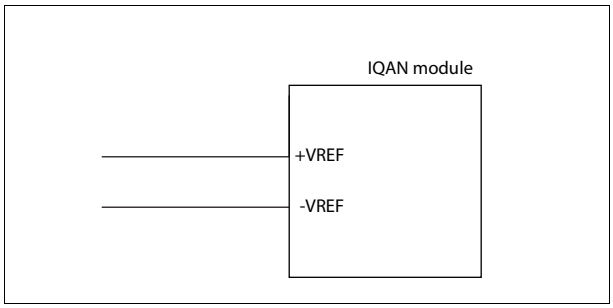
- Check the address number of the module assigned in the application.
- If the module is located at the end of the CAN-bus, then select the appropriate *ID-Tag* denoted with a "T".

NOTICE

The CAN-bus must not be terminated at the module using an external regular terminating resistor, due to the fact that terminating is made from within the module by default or in conjunction with the *ID-Tag*.

Reference voltage, VREF

The IQAN module is internally equipped with a voltage regulator to generate the reference voltage *VREF*. The standard reference voltage will feed different kinds of sensors and potentiometers.



VREF positions.

NOTICE

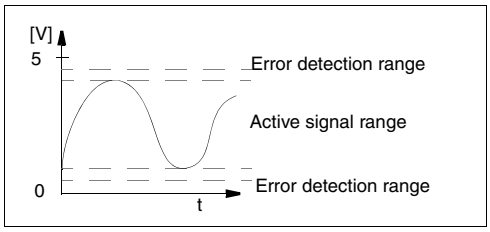
It is strongly recommended to use the module's -*VREF* and +*VREF* to all sensors and potentiometers that are connected to the module inputs. This will reduce bad measurement based on potential fault (i.e. different ground points for other supplies in relation to the IQAN module ground, -BAT).

Maximum load for the *VREF* is different according to 12/24 Vdc power supply, see "Appendix A".

Voltage inputs

Connecting sensors to the voltage inputs

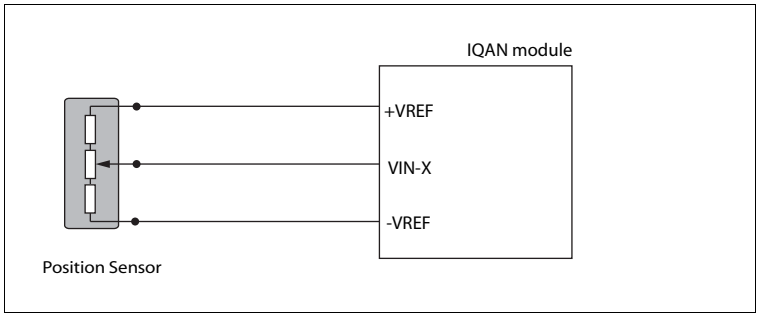
The sensor signal range must be 0-5 Vdc. To detect signal errors such as short circuits or interruptions the active signal range be within 0.5-4.5 Vdc.



Active signal range.

The current consumption related to the voltage input is negligible.
The positive terminal of the sensor is connected to the +VREF position and the corresponding negative terminal to the -VREF position. The sensor signal is connected to appropriate VIN position.

EXAMPLE
Connect the positive and negative terminals of the position sensor to +VREF, and -VREF, respectively. Then connect the sensor signal to VIN-X.



Connecting VREF and sensor signal VIN-X.

NOTICE
The negative terminal of the sensor must not be connected to the chassis.
Maximum load for VREF position: see Appendix A.

Connecting other 3 wire sensors

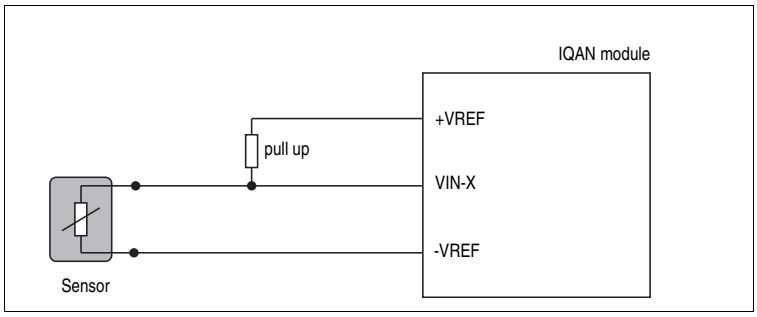
The same type of connection shown for potentiometers is used for other 3 wire sensors supplied with power from the regulated 5VDC supply, VREF. This includes active temperature sensor IQAN-ST, pressure sensor IQAN-SP and Hall-effect levers IQAN-LST or IQAN-LSL.

Connecting a 2-wire temperature sensor to voltage in

When you connect a PTC (positive temperature coefficient) temperature sensor you may need to use a pull up resistor on the input signal. Please check the technical data for your specific temperature sensor.

EXAMPLE

Connect the negative terminal of the temperature sensor to -VREF, and the signal to VIN-X. The pull up resistor will be connected between VIN-X, and +VREF.



Connecting -VREF and temperature sensor signal VIN-X.

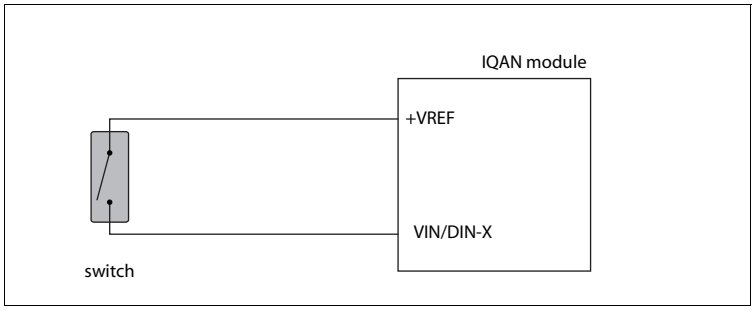
The pull up resistor value for a R_{25}=2000Ω, PTC sensor is 4,7 KΩ.

Connecting switches to the voltage inputs using VREF

Switches could be connected to the voltage inputs, to create a digital on/off signal. The switches should be connected to +VREF and VIN/DIN respectively for 5V signal. The current consumption for the input is negligible.

EXAMPLE

Connect the positive and negative terminals of the switch to +VREF, and VIN-X, respectively.



Connecting a switch to VIN-X and VREF.

NOTICE

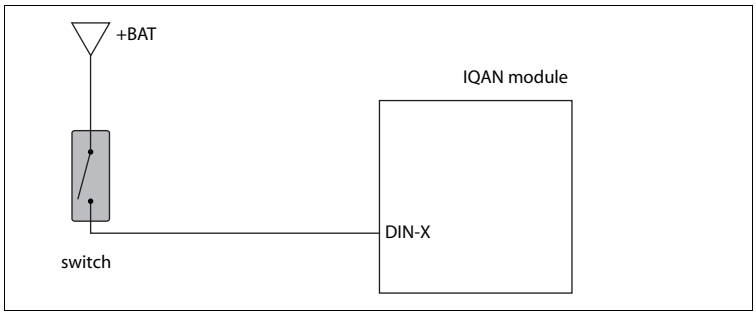
Maximum load for VREF position, see "Appendix A".

Connecting switches to the voltage inputs using +BAT

It is recommended to connect system voltage +BAT to the input through a switch in order to reserve 5Vdc VREF for sensors and potentiometers.

EXAMPLE

Connect the positive and negative terminals of the switch to supply or the unit's +BAT, and DIN-X, respectively.



Connecting a switch to DIN-X and +BAT.

Digital inputs

DIN that share pins with VIN

These digital inputs share pins with the module voltage inputs and have high impedance characteristics. The preceding switch examples apply to these inputs.

DIN that share pins with CRET

These digital inputs share pins with the return pins of the proportional output channels, e.g. CRET and PWMRET. These pins have an internal power clamping diode. If used as inputs they must be connected in a way that prevents ’backending’, that is, supplying power to the module from a source other than its power pin (+BAT).

Carefully read the following section for more information.

Connecting switches to the digital inputs

When connecting switches to the digital inputs, DIN, that share pins with CRET, extra precautions should be taken.

WARNING

The DIN that share pins with the CRET positions of the proportional outputs have a possibility of ’backending’ the IQAN module when using those pins as digital inputs. The internal circuitry has power clamping diodes between CRET pins and the internal power supply. This arrangement creates a risk of inadvertently supplying power to the unit.

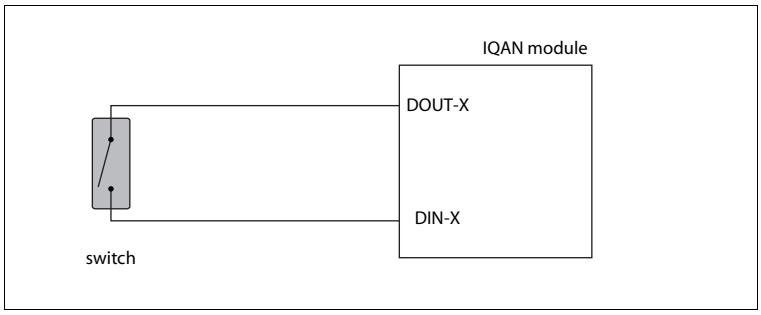
You can safely connect using +VREF for the supply, as shown in the preceding *"Connecting switches to the voltage inputs"* example.

If you would like to preserve +VREF for sensors and joysticks, then there are two additional methods:

1 The switches could be powered by one of the module’s DOUT pins.

EXAMPLE

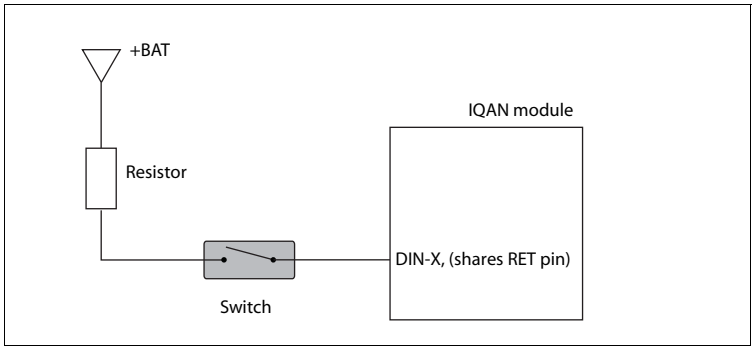
Connect the supply of the switch to DOUT-X, and the signal to DIN-X , respectively.



Connecting a switch to DOUT-X and DIN-X.

2 The switch supply could be connected through a high impedance resistor.

EXAMPLE
Connect the supply of the switch to +BAT through a high impedance resistor, and the signal to DIN-X , respectively.



Connecting a switch to DIN-X and supply through a resistor.

WARNING
Do not exceed 35Kohm for 12 Vdc systems and 50Kohm for 24 Vdc systems!
The DIN signal will not be detected by the module.
Remember that these flexible I/O pins must be configured in pairs of the same type.

Frequency inputs

Connecting sensors to the frequency inputs

Frequency inputs can operate in 2 modes. *Speed* which is frequency and *position* which is a pulse count. For the frequency ranges and trigger levels, see Appendix A.

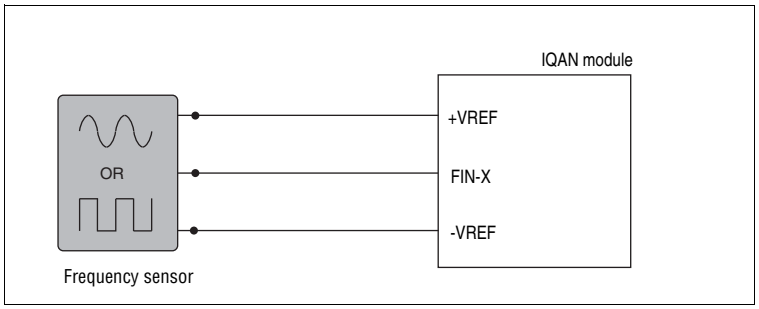
Simple frequency sensor

The positive terminal of the frequency sensor is connected to the +VREF and the negative terminal to the -VREF respectively. The sensor signal is connected to the FIN position.

If the current consumption for the sensor exeeds the maximum load for the VREF, the sensor could be connected to the +BAT/-BAT positions.

EXAMPLE

Connect the positive and negative terminals of the frequency sensor to +VREF, and -VREF, respectively. Then connect the sensor signal to FIN-X.



Connecting of frequency sensor.

NOTICE

The negative terminal of the sensor must not be connected to the chassis.
Maximum load for VREF position, see Appendix A.

Quadrature and directional frequency inputs

Connecting sensors to the inputs

Quadrature sensors are phase dependent. These sensors have two 90 degree out of phase "square wave" type signals for direction indication, and frequency.

Directional sensors are level dependent. These sensors have one "square wave" type signal for speed or position and one signal that is high or low to indicate the direction.

Quadrature and directional inputs can operate in 2 modes. *Speed* which is frequency with direction and *position* which is a pulse count with direction. For the frequency ranges and trigger levels, see Appendix A.

Quadrature sensor

The positive terminal of the quadrature sensor is connected to the +VREF and the negative terminal to the -VREF respectively. The sensor's channel A is connected to DFIN-A+ and channel B to DFIN-A- positions.

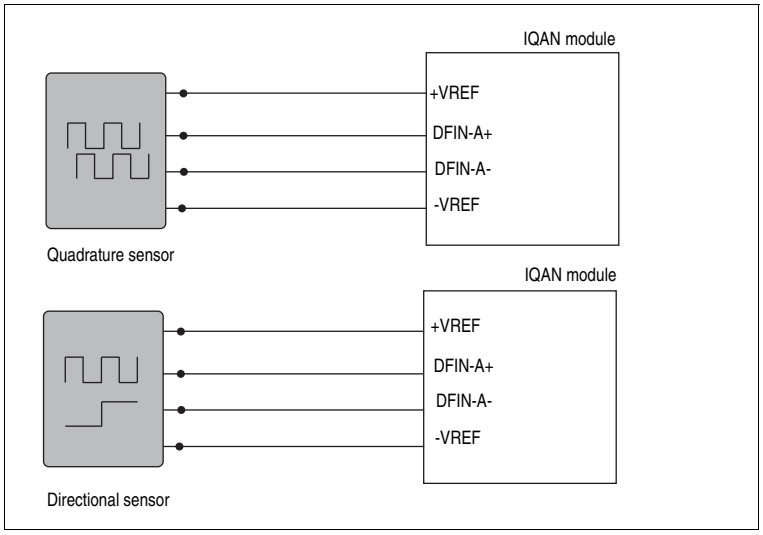
Directional frequency sensor

The positive terminal of the directional sensor is connected to the +VREF and the negative terminal to the -VREF respectively. The sensor output is connected to DFIN-A+ and the sensor direction signal to DFIN-A- position.

If the current consumption for the sensor exeeds the maximum load for the VREF, the sensor could be connected to the +BAT/-BAT positions.

EXAMPLE

Connect the positive and negative terminals of the sensor to +VREF and -VREF respectively. Then connect the sensor signals to DFIN-A+ and DFIN-A-.



Connecting of quadrature or directional frequency sensor.

NOTICE

The negative terminal of the sensor must not be connected to the chassis.
Maximum load for VREF position, see Appendix A.

Proportional outputs

The current /PWM outputs control proportional valves and devices. For the current range and loads, see Appendix A.

Frequency

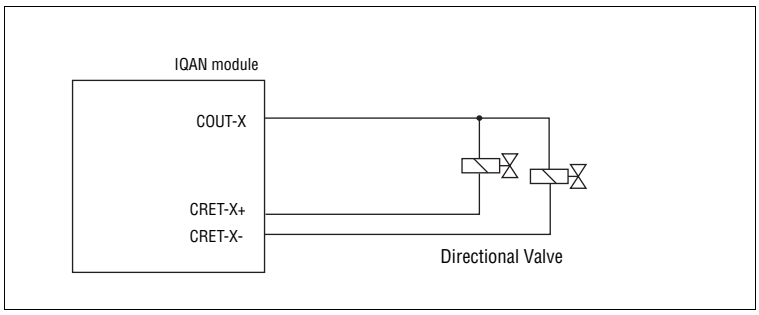
To obtain the best performance from proportional valves the controller produces a current mode (closed loop) output signal or a PWM mode (open loop) output signal. The type of output is selectable in IQAN software. The module has an adjustable frequency which can be changed using IQAN software. For the possible frequencies, see Appendix A.

Connecting loads to proportional COUT outputs

Connecting a load, e.g. one proportional valve section, to the current mode outputs is done by using the COUT/CRET paired positions.

EXAMPLE

Positive direction:
Connect the proportional valve to the COUT-X, and the CRET-X+, respectively.
Negative direction:
Connect the proportional valve to the COUT-X, and the CRET-X-, respectively.



Connecting a load to a proportional output.

NOTICE

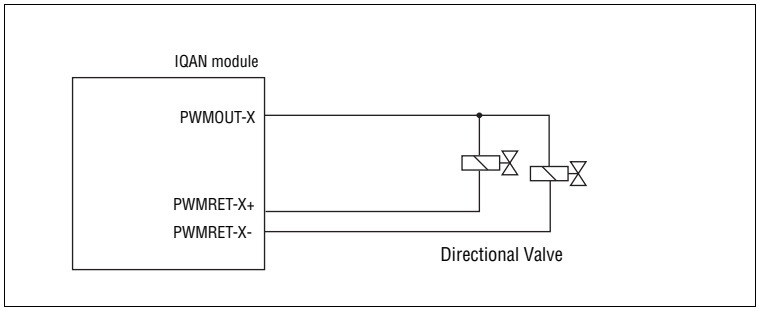
DO NOT install diodes across coils for COUT mode! (In COUT mode an internal clamping diode is used).

Connecting loads to proportional PWMOUT outputs

Connecting a load, e.g. one proportional valve section, to the PWM mode outputs is done by using the PWMOUT/PWMRET paired positions.

EXAMPLE

Positive direction:
Connect the proportional valve to the PWMOUT-X, and the PWMRET-X+, respectively.
Negative direction:
Connect the proportional valve to the PWMOUT-X, and the PWMRET-X-, respectively.



Connecting a load to a proportional output.

NOTICE

DO NOT install diodes across coils for PWMOUT mode for Parker Pulsar solenoids!

NOTICE

DO install diodes across coils for PWMOUT mode on all other solenoids!
If maximum load inductance is exceeded, or if PWM outputs are externally grounded, a clamping diode must be used. Place the diode between the PWMOUT and PWMRET, or the PWMOUT and ground, as close to the load as possible. This protects the output against high voltage transients.
For example, use diode: 1N5408 (3A/1000V).
Depending on the load, other clamping diodes might be used instead.

Digital outputs

The digital outputs control relays and on/off valves.
For the maximum load per output see Appendix A.

Connecting loads to digital outputs

Connecting of loads to the digital outputs such as on/off valves is done by using the DOUT positions and the negative battery terminal as ground.

Protection against voltage transients

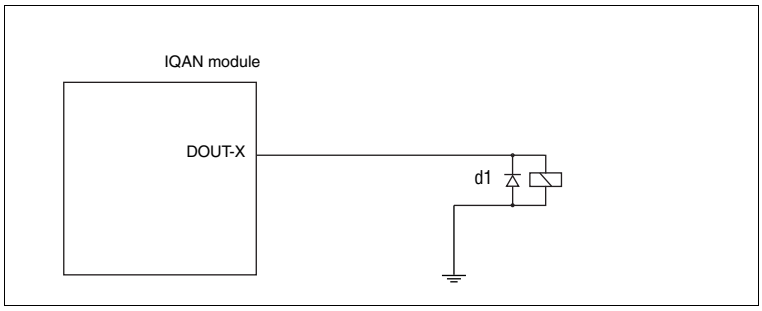
A clamping diode must be placed between the digital output and ground, as close to the load as possible. This protects the output against high voltage transients.
For example, use diode: 1N5408 (3A/1000V).
Depending on the load, other clamping diodes might be used instead.

EXAMPLE

Connect the on/off valve to the digital output using the DOUT-X, and the negative battery terminal as ground.

NOTICE

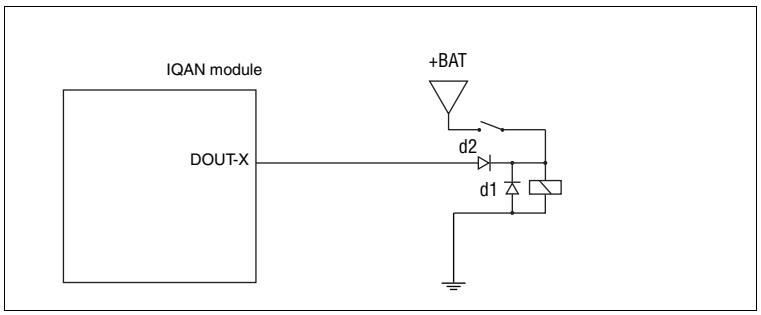
A clamping diode must be placed as close to the load as possible



Connecting a load to the digital output.

NOTICE

If the load is controlled in parallel with another system, the digital output pin must also be protected with a second diode.



Digital output protected with a diode.

7 Start-up

Start-up procedures

This chapter contains instructions for action to be taken in connection with the initial start.

WARNING
Risk of injury!
If the control system is not fitted properly, the machine could move uncontrollably. The machine's engine shall not be started before the control system is completely fitted and its signals are verified.

Starting the control system

Start the control system as follows:

- Prior to start, all modules and cables are to be fitted correctly.
- Check fuses, i.e. make sure that the supply voltage to the modules is equipped with the correct fuse.
- Make sure that connections for supply voltage and return lines are correct in the cable's conductor joint.
- Make sure an emergency stop is installed.
  The emergency stop should disconnect the supply voltage to all modules. Alternatively, the emergency stop may also shut off the diesel engine or a dump valve, and with that, depressurize the hydraulic system.

Prepare for system start

WARNING
Make sure no one is in dangerous proximity to the vehicle to avoid injuries when it starts.

Prepare for the initial system start as follows:

- The engine for the hydraulic system's pump shall be in off position.
- Make sure that all connectors are properly connected.
- Turn on the control system.
- Make sure that voltage is being supplied to all modules; the power/status diode shall be illuminated on all modules. Also, make sure that the master is in contact with all modules by reading the master's display.
- Make sure the emergency stop is functioning properly.

Start the system

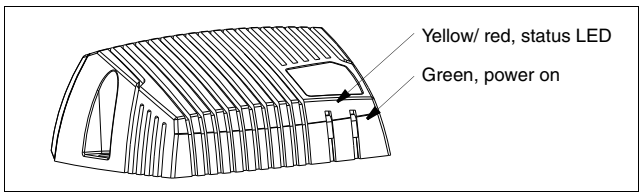
Start the system as follows:

- Start the engine for the hydraulic system's pump, assuming that the above mentioned inspections have been carried out and shown correct values.

Calibrate and adjust input and output signals according to the instructions related to the master menu system and check each and every output function carefully.

8 System Diagnostics

The yellow blinking LED on the top of the module indicates normal status. If there is an error detected, the IQAN module will indicate *error status* through the red blinking LED.
This gives an immediate diagnosis as to the nature of the error that has occurred.



The location of the LED indicators on the IQAN module.

The green LED indicates power on. The yellow/red LED, will be blinking red when an error has been detected. To get further information about the error messages, see Appendix B.

Appendix A

IQAN-XA2 Technical Overview

System

Parameter	Remark
Temperature Operating temperature Absolute maximum temperature Storage temperature	 -40 to 70 °C -40 to 85 °C -40 to 100 °C
Voltage supply Power on threshold Over voltage on any pin Reverse polarity protection on +BAT	9-32 V 6.2 V 34 V with respect to -BAT with external 20A fuse.
-VREF load	2A
Power driver load	total load on power drivers < 20 A
Current supply V_{BAT} =14V V_{BAT} =28V	 typ. 95 mA typ. 75 mA
Start-up time	typ. 250 ms
Weight	750 grams

Environmental ratings

Parameter	Remark
EMI ISO 13766:2010/ISO 14982:2009, Radiated emission EN 55025:2003, Conducted emission ISO 11452-2:1995, Radiated Susceptilbility ISO 11452-4:2001, Conducted Susceptibility ISO 7637-2:1990, Conducted transient susceptibility	 30-1000 MHz 0.15-108 MHz, Class 1 200-2000 MHz, 1 kHz, 80% AM, 100V/m 1-200 MHz, 1 kHz, 80% AM, 150mA Pulse 1,2,2b,3a,3b,4, Level 3; Pulse 5, Level 1
ESD ISO 10605:2001, ESD, operation ISO 10605:2001, ESD, handling	 15KV, air, 8 KV contact 4 KV contact
Mechanical environment IEC 60068-2-64:2008 Fh, Random vibration IEC 60068-2-27:2008 Ea, Shock	 15- 250 Hz, 9.7 Grms, 3 x 10 hrs 40g, 6 ms,1000 x 6 directions
Climate environment IEC 60529:2001, Enclosure protection DIN 40050 Part 9:1993, Enclosure protection IEC 60068-2-30:2005 Db, Damp heat cyclic IEC 60068-2-78:2001 Cab, Damp heat, steady state IEC 60068-2-2:2007 Bb, Heat, operation IEC 60068-2-1:1993 Ab, Cold, operation IEC 60068-2-14:1984 Nb, Change of temperature IEC 60068-2-52:1996 Kb, Salt mist	 IP65 IP6K9K 55°C, 95% RH, 6 cycles 40°C, 93% RH, 21 days 70°C, 72 hrs -40°C, 16 hrs -30°C to 55°C, 10 x 8 hrs 72 hrs

Sensor supply, VREF

T_A = -40 °C to +70 °C (unless otherwise specified)

Parameter	Remark
Number of VREF	1
Output voltage	5 V ±150 mV
Temperature drift	0.25 mV/° C

Sensor supply, VREF

T_A = -40 °C to +70 °C (unless otherwise specified)

Parameter	Remark
Maximum load current	150 mA
Protection	overload, SCB, SCG
Diagnostics	over/under voltage
Under/over voltage threshold	±250 mV from nominal value

I/O

T_A = -40 °C to +70 °C (unless otherwise specified)

Parameter	Remark
VIN (Voltage input)	
Number of VIN	8 (configuration may reduce number)
VIN full scale	5000 mV ±100 mV
VIN resolution	10 bits = 5 mV
Input impedance	62 kohm pull-down in parallel with 470 pF
Accuracy with external sensor supply with VREF sensor supply	 ±100 mV ±35 mV
Protection	SCB, SCG
Diagnostics	Defined in application
DIN (On/off input)	
Number of DIN	20 (configuration may reduce number)
Logic levels low high	 <1 V >4 V
Input hysteresis DIN-A to DIN-H DIN-I to DIN-T	 typ. 1.0 V typ. 0.5 V
Input impedance DIN-A to DIN-H DIN-I to DIN-T	 62 kohm pull-down in parallel with 470 pF 5.6 kohm pull-down in parallel with 10 pF
Diagnostics	Defined in application
FIN (Frequency input) / DFIN (Directional Frequency input)	
Number of FIN / DFIN	2 / 1 (configuration may reduce number)
Frequency range FIN DFIN	 2 to 30,000 Hz(>20 Hz in Fast response) 2 to 30,000 Hz(>20 Hz in Fast response
Minimum pulse width	TBD for 5 V signal
Step response	500 ms, 10% to 90% step
Logic levels low high	 <1 V >4 V
Input hysteresis	typ. 1.0V
Input impedance	62 kohm pull-down in parallel with 470 pF
Diagnostics	Defined in application

I/O

T_A = -40 °C to +70 °C (unless otherwise specified)

Parameter	Remark
PCNT (Pulse Count input) / DPCNT (Directional Pulse Count input)	
Number of PCNT / DPCNT	2 / 1 (configuration may reduce number)
Frequency range PCNT DPCNT	 0 to 20,000 Hz 0 to 20,000 Hz
Minimum pulse width	TBD for 5 V signal
Logic levels low high	 <1 V >4 V
Input hysteresis	typ. 1.0V
Input impedance	62 kohm pull-down in parallel with 470 pF
Diagnostics	Defined in application
Power driver, COUT	
Number of COUT	6 dual outputs
COUT range low high	 100 mA 2000 mA
COUT resolution	0.1 mA
Power driver voltage drop 750 mA load 1500 mA load	 typ. 0.45 V @ saturation typ. 0.90 V @ saturation
Leakage current in OFF state	<2 mA
Maximum COUT saturation	95 % @ 100 Hz dither
Absolute accuracy	±(2% + 15 mA)
Dither frequency, F_{DITH}	see table
Supply rejection	±2 mA, V_{BAT} change 9 to 18 V or 18 to 32 V
Load rejection	±2 mA, load change ±50 %
Maximum load V_{BAT} = 14 V and $F_{DITH} \geq 200$ Hz V_{BAT} = 14 V and $F_{DITH} \leq 167$ Hz V_{BAT} = 28V and $F_{DITH} \geq 200$ Hz V_{BAT} = 28 V and $F_{DITH} \leq 167$ Hz	 5 ohm + 10 mH 5 ohm + 20 mH 10 ohm + 30 mH 20 ohm + 60 mH
Protection	over load, SCB, SCG
Diagnostics	open load, over load, saturation
Power driver, PWMOUT	
Number of PWMOUT	6 dual outputs
PWMOUT range	0% to 95% MR
PWMOUT resolution	0.1 % MR
Dither frequency, F_{DITH}	see table
Power driver voltage drop	typ. 0.90 V @ 1.5 A load
Leakage current in OFF state	<2 mA
Maximum load	2 A
Maximum load inductance V_{BAT} = 14 V V_{BAT} = 28V	without clamping diode 12 Ohm / 8 mH, 28 Ohm / 33 mH 48 Ohm / 28 mH
Protection	over load, SCB, SCG
Diagnostics	no

I/O

T_A = -40 °C to +70 °C (unless otherwise specified)

Parameter	Remark
Power driver, DOUT (on/off output)	
Number of DOUT	12
Maximum load	2 A
Power driver voltage drop	typ. 0.30 V @ 1.5 A load
Leakage current in OFF state DOUT-A to DOUT-F DOUT-G to DOUT-L	 <100 uA <1 mA
Maximum load inductance V_{BAT} = 14 V, single pulse V_{BAT} = 28V, single pulse PWM (incl. Softstart, Softstop)	 14 Ohm / 366 mH, 9.3 ohm / 126 mH, 7 ohm / 50 mH 28 Ohm / 334 mH, 19 ohm / 114 mH, 14 ohm / 46 mH external clamping diode is mandatory
Protection	over load, SCB, SCG
Diagnostics	no

CAN

T_A = -40 °C to +70 °C (unless otherwise specified)

Parameter	Remark
Number of CAN buses	1
CAN specification	2.0A and 2.0B
CAN bus speed	250 kbit
Protection	SCB, SCG

Frequency

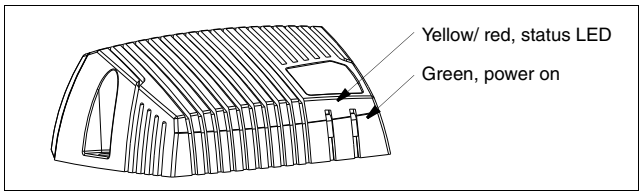
The table below shows the PWM frequency possibilities. Any frequency may be entered in your application and is translated according to this table. The bold values are the actual frequencies in Hz output by the module for proportional valve control.

Frequency (Hz) entered in appl.	Frequency (Hz) output by module	Frequency (Hz) entered in appl.	Frequency (Hz) output by module
25	**25**	50-52	**50**
26	**26**	53-55	**53**
27	**27**	56-58	**56**
28	**28**	59-62	**59**
29	**29**	63-66	**63**
30	**30**	67-70	**67**
31	**31**	71-76	**71**
32	**32**	77-82	**77**
33	**33**	83-90	**83**
34-35	**34**	91-99	**91**
36	**36**	100-110	**100**
37	**37**	111-124	**111**
38-39	**38**	125-142	**125**
40-41	**40**	143-166	**143**
42	**42**	167-199	**167**
43-44	**43**	200-249	**200**
45-47	**45**	250-332	**250**
48-49	**48**	333+	**333**

Appendix B

Error codes, messages and actions

If one of the following error is detected, a message will be presented on the display together with an error code on the module. In some cases, the module will turn off or at least shut down the outputs, to increase safety.



The location of the LED indicators on the IQAN-XA2 module.

WARNING

Don't use the machine if an error message or error code is activated.

The following sections will present what measures to take for different error situations put into appropriate context.

LED indicator showing different XA2 modes

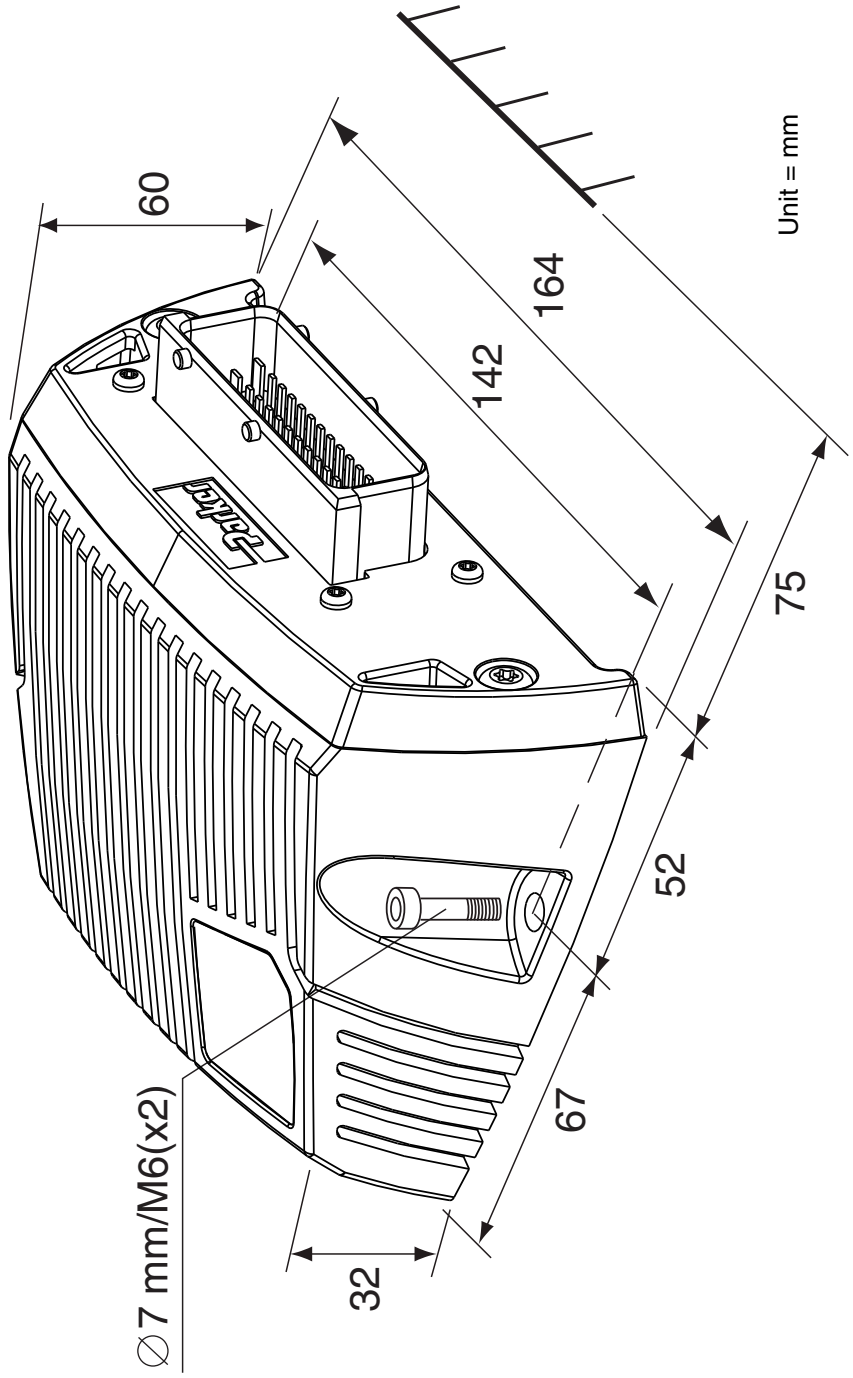
Status	Flash
Normal operation (yel.)	

Error code	Error	Primary Flash (red) Error category	Secondary Flash (yellow) Error description
3:1	CAN error		
3:2	Address error		
4:1	Memory error[a]		
FE	Fatal error		

a. FRAM memory error.

Appendix C

Dimensioning of the IQAN module



Appendix D

Failure Modes

The following tables contain information about the different possible failures that could occur for each module subsystem. In most cases when an error is detected, a message will be presented on the master display together with an error code on the module. In some cases, the module will turn off or at least shut down the outputs, to increase safety.

Failure modes for VREF

Failure mode		Effect
1	+VREF Open	VIN out of range, will create a VIN error => VIN=Predefined error value.[a]
2	-VREF Open	VIN out of range, will create a VIN error => VIN=Predefined error value.[a]
3	+VREF Short-circuit to -VREF	VREF error => VIN out of range, will create a VIN error => VIN=Predefined error value.[a]
4	+VREF Short-circuited to +BAT	VREF error => VIN out of range, will create a VIN error => VIN=Predefined error value.[a]
5	+VREF Short-circuited to -BAT	VREF error => VIN out of range, will create a VIN error => VIN=Predefined error value.[a]
6	-VREF Short-circuited to +BAT	External fuse (if <7.5A) on +BAT blows.
7	-VREF Short-circuited to -BAT	Not detected.

a. Measure is controlled by CAN master and application as a result from the CAN error message. Turning outputs off is controlled by CAN master unit and therefore delayed maximum 2 bus cycles.

Failure modes for CAN interface

Failure mode		Effect
1	CAN-H to -BAT	No CAN communication. All output turned off.
2	CAN-L to -BAT	No CAN communication. All output turned off.
3	CAN-H to +BAT	No CAN communication. All output turned off.
4	CAN-L to +BAT	No CAN communication. All output turned off.
5	CAN-L open circuit	No CAN communication. All output turned off.
6	CAN-H open circuit	No CAN communication. All output turned off.
7	CAN-L to CAN-H	No CAN communication. All output turned off.
8	CAN-termination failure, termination on	No effect
9	CAN-termination failure, termination off	Dependent on CAN size and number of CAN nodes.

Failure modes for VIN

Failure mode		Effect
1	VIN Open	VIN out of range, will create a VIN error => VIN=Predefined error value[a]
2	VIN Short-circuited to +BAT	VIN out of range, will create a VIN error => VIN=Predefined error value[a]
3	VIN Short-circuited to -BAT	VIN out of range, will create a VIN error => VIN=Predefined error value[a]

a. Measure is controlled by CAN master and application as a result from the CAN error message. Turning outputs off is controlled by CAN master unit and therefore delayed maximum 2 bus cycles.

Failure modes for DIN

Failure mode		Effect
1	DIN Open	No effect on module, not detected
2	DIN Short-circuited to +BAT	No effect on module, not detected
3	DIN Short-circuited to -BAT	No effect on module, not detected

Failure modes for FIN

Failure mode		Effect
1	FIN Open	No effect on module, not detected
2	FIN Short-circuit to +BAT	No effect on module, not detected
3	FIN Short-circuit to -BAT	No effect on module, not detected

Failure modes for DFIN

Failure mode		Effect
1	DFIN Open	No effect on module, not detected
2	DFIN Short-circuit to +BAT	No effect on module, not detected
3	DFIN Short-circuit to -BAT	No effect on module, not detected

Failure modes in Current Mode

The table below presents failure modes and effects on I/O.

Failure mode		Effect[a]
1	COUT Open	COUT error, output turned off
2	RET (active) Open	COUT error, output turned off
3	RET (passive) Open	Not detected, will not influence function
4	COUT Short-circuit to RET (active)	COUT error, output turned off[b]
5	COUT Short-circuit to RET (passive)	Not detected, will not influence function
6	COUT Short-circuit to +BAT	COUT error, output turned off
7	COUT Short-circuit to - BAT	COUT error, output turned off[b]
8	RET (active) Short-circuit to +BAT	COUT error, output turned off[b]
9	RET (active) Short-circuit to - BAT	COUT error, output turned off
10	RET (passive) Short-circuit to +BAT	Not detected, will not influence function
11	RET (passive) Short-circuit to - BAT	COUT error, output turned off
12	COUT Short-circuit to 2:nd COUT (passive)	Not detected, will not influence function
13	COUT Short-circuit to 2:nd RET (active)	COUT error, output turned off[b]
14	COUT Short-circuit to 2:nd RET (passive)	Not detected, will not influence function
15	RET Short-circuit to 2:nd RET (active)	COUT error, output turned off
16	RET Short-circuit to 2:nd RET (passive)	Not detected, will not influence function
17	Insufficient Voltage	COUT error, output turned off

a.Turning off outputs are controlled by CAN master and therefore delayed by maximum 2 bus cycles. If local error handling is enabled the output will turn off locally without delay.
b.Turned off by integrated protection functions in IC.

Failure modes in PWM mode

Table below presents failure modes and effects on I/O.

Failure mode		Effect[a]
1	H-side Open	PWMOUT error, output turned off
2	L-side (active) Open	PWMOUT error, output turned off
3	L-side (passive) Open	Not detected, will not influence function
4	H-side Short-circuit to L-side (active)	PWMOUT error, output turned off[b]
5	H-side Short-circuit to L-side (passive)	Not detected, will not influence function
6	H-side Short-circuit to +BAT	PWMOUT error, output turned off
7	H-side Short-circuit to - BAT	PWMOUT error, output turned off[b]
8	L-side (active) Short-circuit to +BAT	PWMOUT error, output turned off[b]
9	L-side (active) Short-circuit to - BAT	Not detected, will not influence function
10	L-side (passive) Short-circuit to +BAT	Not detected, will not influence function
11	L-side (passive) Short-circuit to - BAT	Not detected, + and - direction activated without movement as result.
12	H-side Short-circuit to 2:nd L-side (active)	PWMOUT error, output turned off[b]
13	H-side Short-circuit to 2:nd L-side (passive)	Not detected, will not influence function
14	L-side Short-circuit to 2:nd L-side (active)	Not detected, will not influence function
15	L-side Short-circuit to 2:nd L-side (passive)	Not detected, will not influence function
16	Insufficient Voltage	Not detected, lower max speed limit on function

a. Turning off outputs are controlled by CAN master and therefore delayed by maximum 2 bus cycles. If local error handling is enabled the output will turn off locally without delay.
b. Turned off by integrated protection functions in IC.

For latest information visit our website www.iqan.com

Information in this instructionbook is subject to change without notice

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