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IQAN Electronic Control Systems

North American Product Offering
Catalog HY14-1825/US



ENGINEERING YOUR SUCCESS.

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IQAN

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IQAN for the life of your machine



The state-of-the-art IQAN system is a unique, totally electronic approach that replaces mechanical and electromechanical systems for controlling and monitoring hydraulics in mobile machines. With Parker's IQAN, you have complete freedom to design customized software without advanced programming skills. The functions available within the IQAN system are so flexible that sophisticated applications are quickly programmed and optimized.

The wide range of outdoor modules with flexible I/O available with IQAN ensures complete machine management. The system offers a building-block approach that simplifies component design and installation and reduces development time and expense. IQAN hardware is tested for robust operation and compatibility with mobile hydraulic equipment. In addition, it meets industry and government standards for operation in severe conditions that include extremely high or low temperatures, vibrations, mechanical impact and electromagnetic interference.

IQAN is user-programmable via a high level graphical design tool, which dramatically simplifies development. Simulation of the control system takes place in parallel with the programming of machine functions. The IQAN software tools cover all phases of a machine's life cycle, from development through production to after sales.

IQAN by Parker offers a complete range of control products to meet your needs. The TOC2 and analog joystick products are for basic valve driver applications. The TOC8 is a standalone controller with a flexible I/O setup and J1939 communication for a small machine system. The MDM, MDL and MC2 are CANbus master units. When combined with our versatile expansion modules, such as the XA2 and XT2, you can build a complete control system for a larger, more complicated machine.

IQAN is the solution for:

Development

Time to market is one of the most important factors for return on investment. It is primarily set by design time, application programming, simulating, verifying and creating documentation. IQAN's flexible I/O, building block hardware and user friendly, high-capacity software are essential to meet these demands.

Production

Manufacturer's constantly strive for improved quality, simpler configuration, faster startup and reduced production line set-up time. IQAN's robust hardware and easy to use software can automate the process while helping trace and record delivery status.

After sales

Your customer wants a reliable machine with minimum downtime, simple maintenance and maximum field service support. IQAN is made for severe conditions and has software to make routine service simple. If needed, IQAN has comprehensive system diagnostic tools.





Contents

When ordering IQAN Studios, the following items are included:

- IQAN Studio software CD-ROM
- 1 licence

The user's manual for IQANdesign is provided in electronic format and may be downloaded from our website, www.iqan.com. For a printed manual, contact Parker Catalog Services.

Communication cables are not included. Order the cables you need from the accessories section.

Requirements

CPU	PC compatible, Pentium® II 233 MHz or better
RAM	minimum 256 Mbyte (512 Mbyte recommended)
HD	100 Mbyte storage space available
Ports	serial port, RS232 or USB port
Display	XVGA (1280x1024 recommended)
Software	Windows® 2000, XP (Windows® XP is recommended)

Upgrade

It is always possible to download the latest version from our web site www.iqan.com.

Application

The IQAN software studios cover all phases of a machine's life cycle, from development through production to after sales. There are three different studios available; IQAN Creative Studio, IQAN Productive Studio and IQAN Active Studio.

IQAN Creative studio

IQAN Creative studio is a user-programmable software package for the R&D department. It includes tools for application development, simulation and initial setup.

- IQANdesign
- IQANsimulate
- IQANrun

IQAN Productive studio

IQAN Productive studio is a software package for the manufacturing and service departments. It includes development tools for customization and automation of production and maintenance processes.

- IQANscript
- IQANcustomize
- IQANsimulate
- IQANrun

IQAN Active studio

IQAN Active studio is a software package for service and production personnel. It includes tools for machine diagnostics, setup and simulation.

- IQANrun
- IQANsimulate

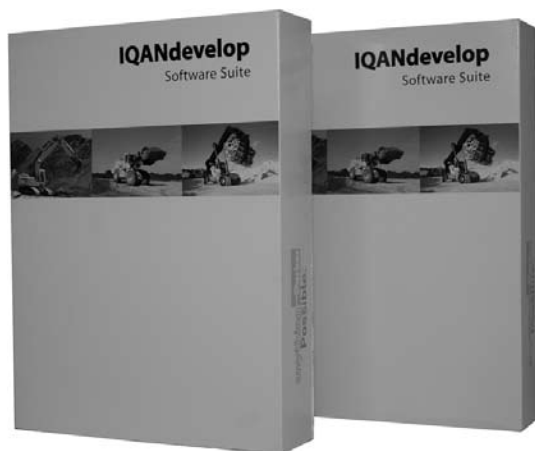
IQAN Studios are used with the newest IQAN products including the IQAN-MD3 and IQAN-MDL master/display units and also with the IQAN-MC2 controller.

Description

IQAN Creative Studio
IQAN Productive Studio
IQAN Active Studio

Ordering PN

20073643
20073644
20073642



Contents

When ordering IQANdevelop, the following items are included:

- IQANdevelop software CD-ROM
- 1 licence
- 1 serial cable
- 1 simulation cable (PRO version only)

The user's manual for IQANdevelop is available in electronic format and may be downloaded from our website, www.iqan.com.

Requirements

CPU	PC compatible, Pentium® II 233 MHz or better
RAM	minimum 256 Mbyte (512 Mbyte recommended)
HD	100 Mbyte storage space available
Ports	serial port, RS232 or USB port
Display	XVGA (1280x1024 recommended)
Software	Windows® 2000, XP (Windows® XP is recommended)

Upgrade

It is always possible to download the latest version from our web site www.iqan.com.

Application

IQANdevelop is a software tool for adding modules and channels to the IQAN control system in order to build functions for the developer's mobile machine application.

The software is based on the different modules' block diagrams. To add a new module, you create a new block diagram. From the block diagram it is easy to set/edit channel parameters and measure the IQAN system.

With the navigator function in IQANdevelop you get an overview of the connected channels in a specific function. In this way it is easy to see how the channels interact with each other.

IQANdevelop is also a tool for measuring and troubleshooting IQAN systems. With a logging function, measurements can be viewed graphically. IQANdevelop PRO also includes IQANsimulate, for performing a virtual test of your application before installing it on the machine. IQANsimulate requires a National Instruments CAN communication card in order to operate.

IQANdevelop Change is a service tool which simplifies setup during production or after-sales service for your IQAN controlled mobile machine. Features that have been set as adjustable are easily accessed with the Change software by production employees and service personnel to fine tune and troubleshoot your machine's operation.

IQANdevelop software is used with the IQAN-MDM master/display and also with the IQAN-TOC8 and IQAN-TOC2 standalone controllers.

Description	Ordering PN
IQANdevelop PRO	20005607
IQANdevelop Change	20005606



General

Weight	0.3 Kg
Operating temperature	-30 to +60 °C -25>LCD off >+75 °C
Protection	outdoor use
Voltage supply	11- 32 Vdc
Current consumption (idle)	130 mA (28 Vdc) 190 mA (14 Vdc)

Performance

Processor	32-bit (144 MHz)
Logging	80K records
Sample time	min 10ms
Software tools	IQANdesign family

Communication interfaces

CAN (ISO 11898)	2
Protocols	ICP, SAE J1939, CANopen, etc
RS-232	1
Protocols	AT-Hayes, GSM07.07, GSM07.05, IDP
USB 2.0 (full speed)	1

Outputs

Digital output	1
Type	high side switch
Max load	200 mA

Inputs

Voltage inputs	7
Signal range	0 - 5 Vdc
Resolution	1.2 mV
Digital inputs	(7) ¹
Signal high	4 Vdc
Signal low	1 Vdc

1) The voltage and digital inputs share the same physical pins. The user defines the channels/pins with IQANdesign.

Application

The IQAN-MD3 is a master unit that works with a variety of expansion modules in the IQANdesign platform control system. The MD3 is fully programmable for use in any machine application, as a graphical user interface and as a CAN gateway.

The IQAN-MD3 is constructed to be weatherproof for outdoor use. The MD3 will display vehicle data and system information.

The IQAN-MD3 has a 3.5" transfective TFT color display. There are five navigation buttons and four 'soft' function buttons to make interaction with the control simple for the operator.

The unit is designed to be easily mounted in a vehicle dashboard or exterior control panel. The unit has two sealed and keyed Deutsch DTM 12 position connectors.

For time critical functions the MD3's sample rate can be set as low as 10 ms. The unit has a large internal memory for events and logging that is capable of storing 80,000 records.

The MD3 analog inputs accept 0-5V signals from input devices or sensors. These inputs can also be set up as on-off inputs. A digital output is available and may be used for alarm or alert signals.

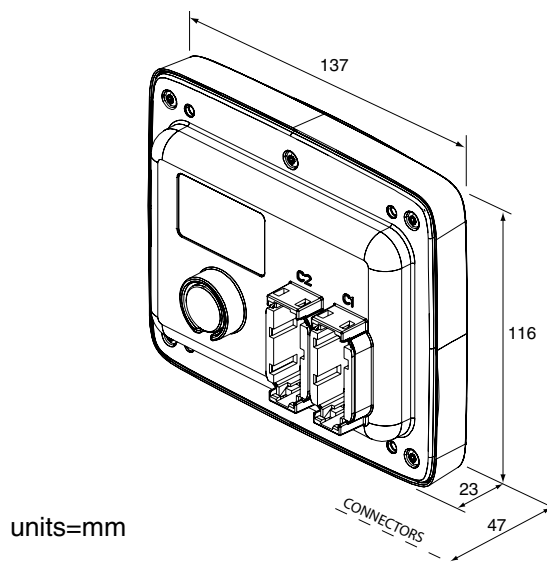
The MD3 is connected to other units by two CAN busses. All CAN busses may be configured as ICP (IQAN CAN Protocol), SAE J1939 or Generic CAN. The unit supports RS232 for modem (remote diagnostic) connection and USB for communication with a PC.

Description

IQAN-MD3

Ordering PN

20072409





General

Weight	0.7 Kg
Operating temperature	-40 to +70 °C
Protection	in-cab use
Voltage supply	11 - 32 VDC
Current consumption (idle)	180 mA (28 VDC) 170 mA (14 VDC)
Data interface	
Type	Parker ICP (IQAN CAN Protocol) J1939, generic, etc.
Communication ports	
Type	RS232, USB
Modem	
Type	GSM triband (900/1800/1900 MHz)

Outputs

Proportional outputs	
Type current mode	current - closed-loop
PWM mode	voltage - open-loop
Signal range	50 - 2000 mA
Dither frequency	25 - 333 Hz
Resolution	1 mA
Digital outputs	
Type	high side switch
Max load	2 A

Inputs

Voltage inputs	
Signal range	0 - 5 VDC
Resolution	5 mV
Frequency inputs	
Signal range (speed mode)	2 - 30000 Hz
(position mode)	0 - 30000 Hz
Quadrature inputs	
Signal range (speed mode)	2 - 30000 Hz
(position mode)	0 - 30000 Hz
Digital inputs	
DIN-A thru -D, DIN-M thru -P	
Signal high	>2 VDC
Signal low	<0.8 VDC
DIN-E thru -L	
Signal high	>3 VDC
Signal low	<2.5 VDC

Application

The IQAN-MDL is a central unit that works with a variety of expansion modules in an IQAN control system. The MDL works as a master, displays information, provides a data gateway and has a variety of flexible I/O channels.

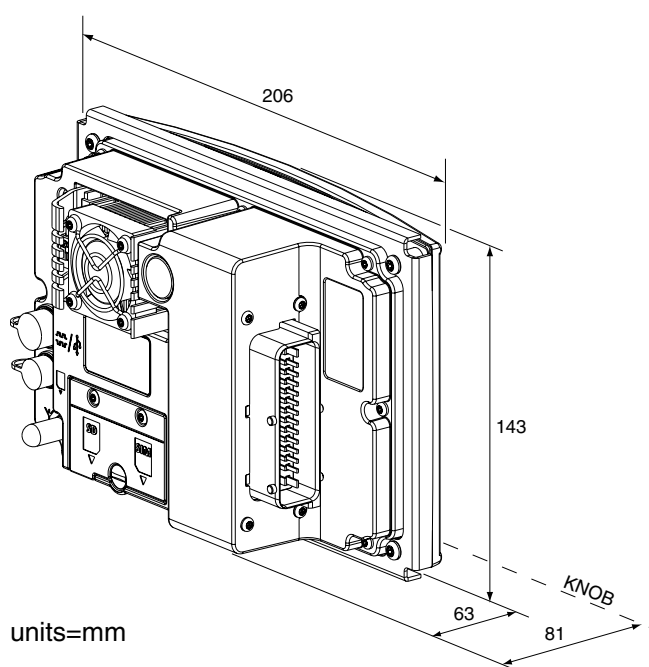
The IQAN-MDL is intended for the in-cab environment and will display vehicle data and system information. In most applications the display will replace all mechanical dial type instruments. The MDL has a 6.5" transfective TFT color display that has very high optical performance across a wide range of operating conditions.

The MDL can control proportional valves using current mode (current closed-loop) or PWM mode (voltage open-loop) signals. The analog inputs accept 0-5V signals from input devices or sensors. These inputs can also be set up to accept one frequency or directional frequency (quadrature) input. Many outputs may alternatively be used as digital inputs for switches. The unit also has 4 CAN interfaces, all of which are user configurable. The MDL is connected to other units by a CAN bus. The unit has two RS232 ports for communication, a USB port and an embedded GSM triband modem.

The back of the unit has an SD memory slot for convenient data logging, a SIM card slot and an SMA antenna connection for the modem. The MDL is ready for advanced telematic functions.

Description

Ordering PN





General

Weight	0.7 Kg
Temperature range	-40 to +70 °C
Protection	outdoor use
Voltage supply	11- 32 VDC
Current consumption (idle)	160 mA (28 VDC) 200 mA (14 VDC)
Data interface	
Type	Parker ICP (IQAN CAN Protocol) J1939, Generic CAN
Communication port	
Type	USB 1.1

Outputs

Proportional outputs	
Type current mode	current - closed-loop
PWM mode	voltage - open-loop
Signal range	100 - 2000 mA
Dither frequency	25 - 333 Hz
Resolution	1 mA
Digital outputs	
Type	high side switch
Max load	2000 mA

Inputs

Voltage inputs	
Signal range	0 - 5 VDC
Resolution	5 mV
Frequency inputs	
Signal range (speed mode)	2 - 20000 Hz
(position mode)	0 - 20000 Hz
Digital inputs	
Signal high	4 VDC - V_{BAT}
Signal low	0 - 1 VDC

Application

The IQAN-MC2 is a flexible master unit for the IQAN bus system. This unit is suitable for use as either a Bus master or standalone control. The IQAN-MC2 has new I/O flexibility that allows the user greater freedom in defining signals for both measurement and control.

The different input types are voltage, on/off, pulse and frequency. The outputs are proportional and on/off. The unit also has two CAN interfaces for bus communication using IQAN CAN Protocol (ICP) and SAE J1939 or Generic CAN.

The MC2 is equipped with a Real Time Clock and can perform data logging functions.

The IQAN-MC2 can control proportional valves using current mode (current closed-loop) or PWM mode (voltage open-loop) signals. The analog inputs will accept 0-5V signals from input devices or sensors. The inputs can also be configured for 5 frequency inputs. Some outputs may alternatively be used as voltage inputs or digital inputs for switches. For communication and diagnostics the MC2 has a USB interface.

The aluminum housing is designed to be rugged, but light and has a sealed, automotive AMP/Tyco power timer connector. The IQAN-MC2 has a membrane to prevent condensation inside the housing. Additional protection allows the unit to be steam-cleaned. This controller is designed for the outdoor environment.

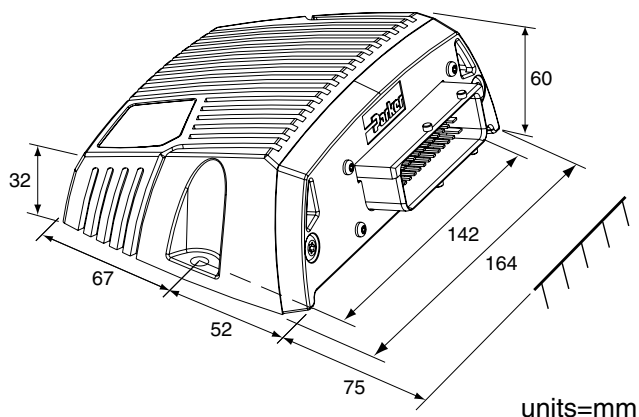
Diagnostics: If an error is detected an LED on the top of the controller flashes a sequence to indicate the nature of the error.

Description

IQAN-MC2

Ordering PN

20070899





General

Weight	0,2 kg
Rated power supply	12-24 Vdc
Min/max power	9/32 Vdc
Operating temperature	-30°C to +70°C
(reduced display update)	-30°C to -10°C
Protection	outdoor use
Current consumption	max 100 mA (28 Vdc), max 180 mA (14 Vdc)
Data interface	Parker ICP (IQAN CAN Protocol)

Display

Type	2.8" B/W LCD
Resolution	202x32 pixels
Performance	
Processor	16-bit (16 MHz)
Sample time	20-100 ms
Software tools	IQANdevelop family

Communication interfaces

CAN (ISO 11898)	1
Protocols	ICP, SAE J1939, CANopen, etc
RS-232	1
Protocols	AT-Hayes, GSM07.07, GSM07.05, IDP

Outputs

Digital output	1
Type	high side switch
Max load	1,2 A
Buzzer	Sound alarm output

Application

The IQAN-MDM is a master unit that works with the expansion modules in the IQANdevelop platform control system. The IQAN-MDM is fully programmable for use in any machine application. The unit works as a master for controlling applications, as a graphical user interface and as a CAN interface.

IQAN-MDM uses an improved 2.8" FSTN, black & white LCD for the best readability in all lighting conditions. The improved display uses Chip-On-Glass technology for higher reliability.

Function buttons and control buttons in combination with a graphical display makes system feedback with user interaction possible. With the three function buttons, a decrease/increase value-button and an escape-button, it is easy to adjust, calibrate and measure the IQAN system. In case of an error the display will alert the operator with a signal and a message on the display.

IQAN-MDM is designed for in-cab as well as outdoor use. It can be used in both 12 and 24 Vdc systems. The IQAN-MDM is connected to other units by a CAN bus. The CAN bus may be configured as ICP (IQAN CAN Protocol), SAE J1939 or Generic CAN. The RS232 interface is used for connection with PC and for land line or wireless modem (remote diagnostic) connection.

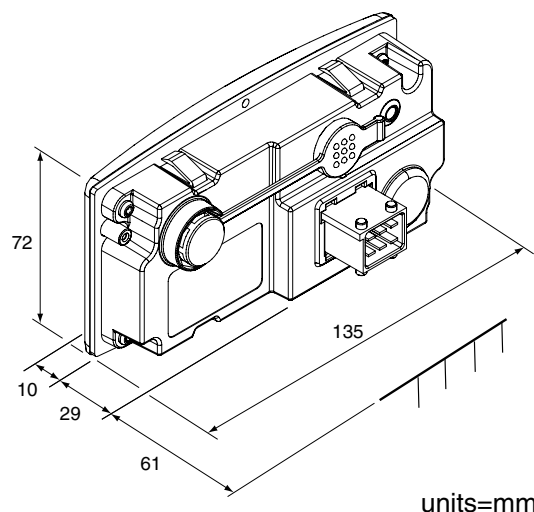
The IQAN-MDM also contains a real time clock, an alarm output and can present text in 10 different languages. A green LED indicator on the back of the module indicates supply voltage and status "heartbeat".

Description

IQAN-MDM

Ordering PN

5010010



units=mm



General

Weight	0.7 Kg
Operating temperature	-40 to +70 °C
Protection	outdoor use
Voltage supply	11- 32 VDC
Current consumption (idle)	180 mA (28 VDC) 170 mA (14 VDC)
Data interface	Parker ICP (IQAN CAN Protocol)

Outputs

Proportional outputs	
Type current mode	current - closed-loop
PWM mode	voltage - open-loop
Signal range	100 - 2000 mA
Dither frequency	25 - 333 Hz
Resolution	1 mA
Digital outputs	
Type	high side switch
Max load	2 A

Inputs

Voltage inputs	
Signal range	0 - 5 VDC
Resolution	5 mV
Frequency inputs	
Signal range (speed mode)	2 - 30000 Hz
(position mode)	0 - 30000 Hz
Quadrature inputs	
Signal range (speed mode)	2 - 30000 Hz
(position mode)	0 - 30000 Hz
Digital inputs	
Signal high	4 VDC - V_{BAT}
Signal low	0 - 1 VDC

Application

The IQAN-XA2 is the next generation of expansion module in the IQAN product group. This unit is designed for high digital I/O count, weather resistance, and safety.

All IQAN expansion modules communicate with a master over a CAN bus. The XA2 module has new I/O flexibility that allows the user greater freedom in defining signals for measurement and control.

The IQAN-XA2 can control proportional valves using current mode (current closed-loop) or PWM mode (voltage open-loop) signals. The analog inputs accept 0-5V signals from input devices or sensors. These inputs can also be set up to accept 4 frequency or 2 directional frequency (quadrature) inputs. Many outputs may alternatively be used as digital inputs for switches. The XA2 also has a number of high power digital (on-off) outputs.

The aluminum housing is designed to be rugged, but light and has a sealed, automotive AMP/Tyco power timer connector. The XA2 has a membrane to prevent condensation inside the housing. This controller is designed for the outdoor environment.

The unit executes a self-test during start up and cyclic operation. An internal watch dog checks for software errors and will interrupt outputs if errors are detected. The IQAN-XA2 is made using selected components and conforms to strict international requirements.

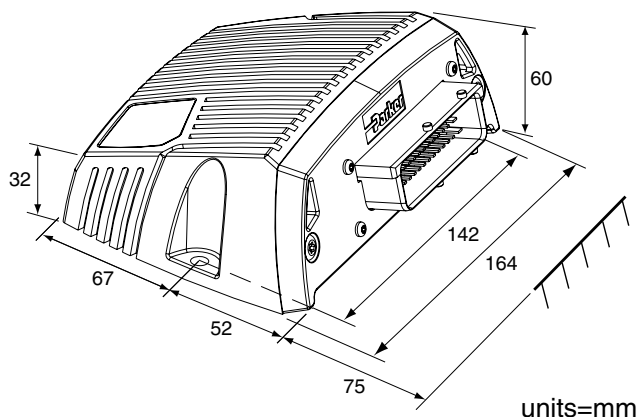
Diagnostics: If an error is detected an LED on the top of the controller flashes a sequence to indicate the nature of the error.

Description

Ordering PN

IQAN-XA2

5010033





General

Weight	0.7 Kg
Operating temperature	-40 to +70 °C
Protection	outdoor use
Voltage supply	11- 32 VDC
Current consumption (idle)	180 mA (28 VDC) 170 mA (14 VDC)
Data interface	Parker ICP (IQAN CAN Protocol)

Outputs

Digital outputs	
Type	high side switch
Max load	2 A

Inputs

Voltage inputs	
Signal range	0 - 5 VDC
Resolution	5 mV
Digital inputs	
Signal high	4 VDC - V_{BAT}
Signal low	0 - 1 VDC

Application

The IQAN-XS2 is the next generation of expansion module in the IQAN product group. This unit is designed for high digital I/O count, weather resistance, and safety.

All IQAN expansion modules communicate with a master over a CAN bus. The XS2 module has a large number of inputs and outputs that allows the user to have fewer modules for digital signals.

The IQAN-XS2 can control valves using digital (on-off) output signals. The analog inputs accept 0-5V signals from input devices or sensors. These analog inputs may alternatively be used as high impedance digital inputs for switches. The XS2 also has a number of dedicated digital (on-off) inputs.

The aluminum housing is designed to be rugged, but light and has a sealed, automotive AMP/Tyco power timer connector. The XS2 has a membrane to prevent condensation inside the housing. This controller is designed for the outdoor environment.

The unit executes a self-test during start up and cyclic operation. An internal watch dog checks for software errors and will interrupt outputs if errors are detected. The IQAN-XS2 is made using selected components and conforms to strict international requirements.

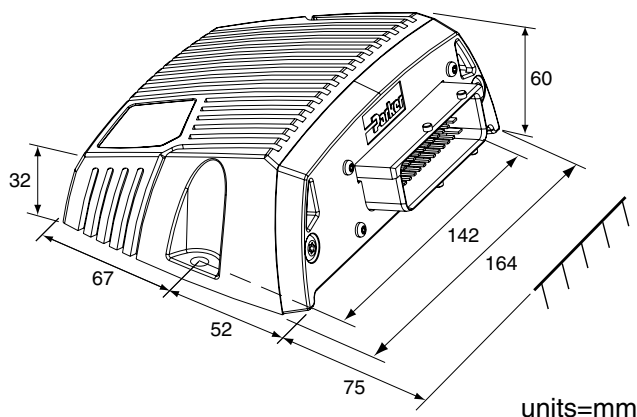
Diagnostics: If an error is detected an LED on the top of the controller flashes a sequence to indicate the nature of the error.

Description

IQAN-XS2

Ordering PN

5010017





General

Weight	0.7 Kg
Operating temperature	-40 to +70 °C
Protection	outdoor use
Voltage supply	9 - 34 VDC
Current consumption (idle)	180 mA (28 VDC) 170 mA (14 VDC)
Data interface	Parker ICP (IQAN CAN Protocol)
Additional CAN hub	J1939 or other byte aligned CAN protocol

Outputs

Proportional current outputs	
Number	2 double
Signal range	60 - 1800 mA
Dither frequency	25 - 150 Hz
Dither amplitude	0 - 500 mA
Resolution	0.7 mA
Digital/ PWM (no current feedback)	
Number	6 / 3 double
Type	high side switch
Max load	3 A
PWM frequency	25 - 2000 Hz
E-gas/Servo motor output (PWM H-bridge)	
Number	1
Signal Range	0-100% rated power
Max load	2,5A

Inputs

Voltage/Frequency	
Number	10/3
Signal range	0 - 5 VDC
Resolution	5 mV
Frequency range	1-10 000 Hz

Application

IQAN-XT2 is one of the “rugged generation” of IQAN expansion modules. Key improvements for this generation of modules are flexibility, weather resistance and safety.

All IQAN expansion modules communicate with a master over a CAN-BUS serial link. The XT2 has an additional CAN hub designed to interface with J1939 diesel engines on mobile machinery and has a dedicated output for electronic throttle control.

The XT2 module has a flexible I/O interface which gives system designers increased options. The same physical pin can be used for different types of inputs or outputs. New types of I/O such as E-gas and PWM outputs increase the flexibility of the module. Digital outputs now have features such as softstart and peak & hold. The J1939 CAN hub allows the XT2 to communicate directly with an electronic engine control bus.

The aluminum housing is designed to be rugged, but light and has a sealed, automotive AMP/Tyco power timer connector. The XT2 has a membrane to prevent condensation inside the housing. This controller is designed for the outdoor environment.

The unit executes a self-test during start up and cyclic operation. An internal watch dog checks for software errors and will interrupt outputs if errors are detected. The IQAN-XT2 is made using selected components and conforms to strict international requirements.

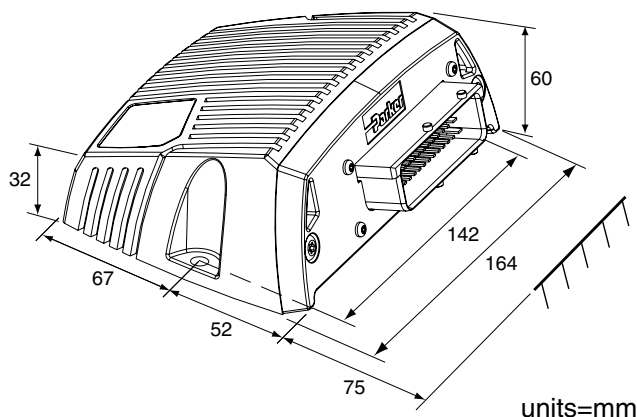
Diagnostics: If an error is detected an LED on the top of the controller flashes a sequence to indicate the nature of the error.

Description

IQAN-XT2

Ordering PN

5010018



**General**

Weight	LM 0,4 Kg, LL 0,9 Kg
Rated power supply	12 – 24 VDC
Min/max power	9 / 32 VDC
Operating temperature	-30 to +70 °C
Protection	in-cab use
Current consumption (idle)	57 mA (28 VDC), 46 mA (14 VDC)
Data interface	Parker ICP (IQAN CAN Protocol)

Axis sensors

Number	max 3 pcs, inductive
Resolution	9 bit

Neutral position detection

Signal	IR-sensor, on/off
--------	-------------------

Digital inputs

Number	10 pcs, 4 internal, 6 external (differs according to handle)
Signal range	0 – 5 VDC 0 – 32 VDC
Active range	"0" = 0,0 – 1,0 VDC, "1" = 2,0 – 32,0 VDC

Analog inputs

Number	2 pcs
Signal range	0 – 5 VDC 0 – 32 VDC
Active range	0,5 – 4,5 VDC
Resolution	5 mV

Digital outputs

Number	1 pc
(takes place of 1 digital input)	
Signal	200 mA

Application

IQAN-LM is especially suitable for continuous duty machine operations such as in forestry and construction work. The combination of a mini-lever and armrest provide substantial ergonomic benefits.

IQAN-LL is designed for rough handling. The ergonomic design gives good support to the arms and wrists and assures a comfortable grip from several angles. The design allows operators to quickly become familiar with the lever.

Both levers are designed for in-cab use, one type for connection to both 12 VDC and 24 VDC systems. All inputs and outputs are protected against short circuit to ground and to main power supply.

The IQAN levers are connected to other modules through a CAN bus which makes data exchange more efficient, simplifies installation and increases noise immunity. The lever units are lightweight with small installation dimensions and have low, well-adapted actuating forces.

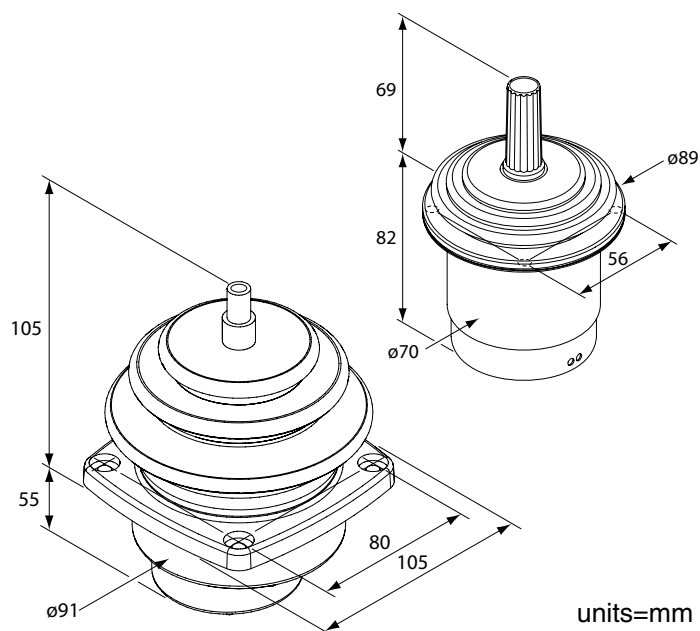
All proportional inputs are of contactless inductive type with neutral position sensors to provide high safety and reliability. A LED indicator shows supply voltage and internal operation.

A number of different handle types are available.

Description**Ordering PN**

IQAN-LL-2U (no handle)	20005961
IQAN-LM-2A (stick handle)	20005963

Consult datasheet and pricelist for other handle options and ordering part numbers.



units=mm



General

Weight	0.7 Kg
Operating temperature	-40 to +70 °C
Protection	outdoor use
Voltage supply	9 - 34 VDC
Current consumption (idle)	105 mA (28 VDC) 90 mA (14 VDC)
Data interface	Parker ICP (IQAN CAN Protocol)

Outputs

Proportional current outputs	
Number	4 double
Signal range	60 - 1800 mA
Dither frequency	25 - 150 Hz
Dither amplitude	0 - 500 mA
Resolution	0.7 mA
Digital/ PWM (no current feedback)	
Number	4/ 2 double
Type	high side switch
Max load	3 A
PWM frequency	25 - 2000 Hz

Inputs

Voltage/Frequency	
Number	4/2
Signal range	0 - 5 VDC
Resolution	5 mV
Frequency range	1-30000 Hz

Application

IQAN-XP2 is one of the “rugged generation” of IQAN expansion modules. Key improvements for this generation of modules are flexibility, weather resistance and safety.

All IQAN expansion modules communicate with a master over a CAN-BUS serial link. Mobile machine I/O is controlled by selecting the appropriate expansion module from the IQAN product family.

The XP2 module has a flexible I/O interface which gives system designers increased options. The same physical pin can be used for different types of I/O.

Various types of I/O such as PWM outputs increase the flexibility of the module. Digital outputs have features including softstart and peak & hold.

The aluminum housing is designed to be rugged, but light and has a sealed, automotive AMP/Tyco power timer connector. The XP2 has a membrane to prevent condensation inside the housing. This controller is designed for the outdoor environment.

The unit executes a self-test during start up and cyclic operation. An internal watch dog checks for software errors and will interrupt outputs if errors are detected. The IQAN-XP2 is made using selected components and conforms to strict international requirements.

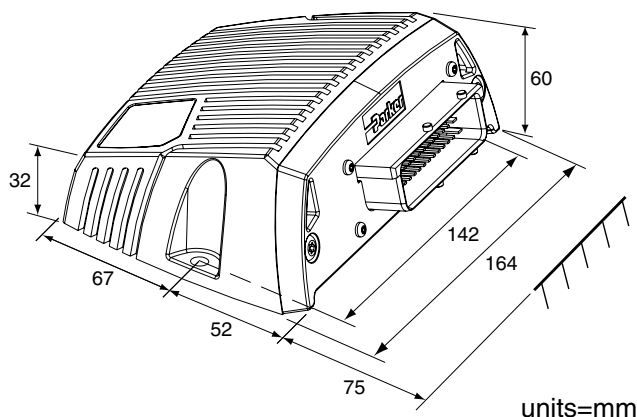
Diagnostics: If an error is detected an LED on the top of the controller flashes a sequence to indicate the nature of the error.

Description

IQAN-XP2

Ordering PN

5010016



**General**

Weight	0.7 Kg
Operating temperature	-40 to +70 °C
Protection	outdoor use
Voltage supply	9 - 34 VDC
Current consumption (idle)	180 mA (28 VDC) 170 mA (14 VDC)
Data interface	RS232 (using IQANdevelop)
CAN hub	J1939 or other byte aligned CAN protocol

Outputs

Proportional current outputs	
Number	2 double
Signal range	60 - 1800 mA
Dither frequency	25 - 150 Hz
Dither amplitude	0 - 500 mA
Resolution	0.7 mA
Digital/ PWM (no current feedback)	
Number	6 / 3 double
Type	high side switch
Max load	3 A
PWM frequency	25 - 2000 Hz

Inputs

Voltage/Frequency	
Number	10/4
Signal range	0 - 5 VDC
Resolution	5 mV
Frequency range	2-10 000 Hz

Application

IQAN-TOC8 is from the same family as the "rugged" generation of expansion modules in the IQAN product group. These modules focus on flexibility, weather resistance and safety.

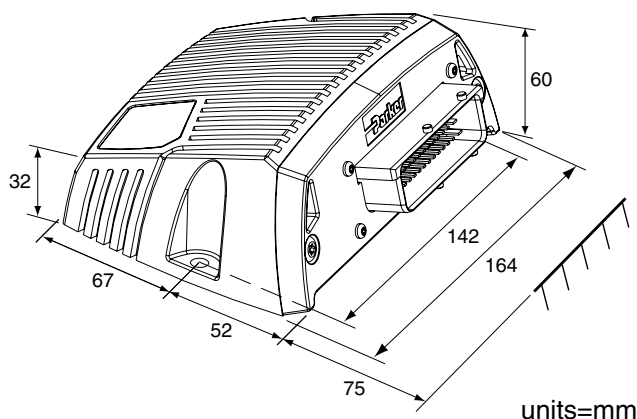
IQAN-TOC8 is a general purpose controller and communicates with a variety of input and output devices. It connects to a laptop PC and is programmed with IQANdevelop software. No Master module is required. It has proportional current outputs for valve control, digital/PWM outputs for auxiliary functions and analog/digital inputs for signals like pressure, RPM or temperature. The unit has a CAN hub designed to interface with a SAE J1939 network.

The IQAN-TOC8 has a flexible I/O interface. The same physical pin can be used for different types of I/O. New types of I/O such as digital PWM outputs increase the flexibility of the controller. The digital outputs have new features such as softstart and peak & hold.

The aluminum housing is designed to be rugged, but light and has a sealed, automotive AMP/Tyco power timer connector. The TOC8 has a membrane to prevent condensation inside the housing. This controller is designed for the outdoor environment.

The unit executes a self-test during start up and cyclic operation. An internal watch dog checks for software errors and will interrupt outputs if errors are detected. The IQAN-TOC8 is made using selected components and conforms to strict international requirements.

Diagnostics: If an error is detected an LED on the top of the controller flashes a sequence to indicate the nature of the error.

Description
IQAN-TOC8**Ordering PN**
5010024

**General**

Weight	0.2 Kg
Operating temperature	-40 to +70 °C
Protection	outdoor use
Voltage supply	9 - 34 VDC
Current consumption (idle)	60 mA (28 VDC) 40 mA (14 VDC)
Data interface	mechanical encoder or RS232 (using IQANdevelop)
VREF output	4.9 - 5.1 VDC 30 mA (28 VDC)

Outputs

Current / PWM outputs	
Number	2 double
Type current mode	current - closed loop
PWM mode	voltage - open loop
Min. threshold	50 mA
Max. load	3000 mA
Dither frequency	25 - 333 Hz
Resolution	1 mA

Inputs

Voltage inputs	
Number	2
Signal range	0 - 5 VDC
Resolution	5 mV
Digital inputs	
Number	2
Signal high	4 VDC - V_{BAT}
Signal low	0 - 1 VDC

Application

The IQAN-TOC2 is a simple task oriented controller in the IQAN product group. This unit is designed for ease of setup, weather resistance, and safety.

The TOC2 is a general purpose unit that can control two bi-directional valve sections or two cartridge solenoids simultaneously. The IQAN-TOC2 communicates with a variety of input and output devices. It has current mode (current closed-loop) or PWM mode (voltage open-loop) output for valve control. The analog inputs accept signals from joysticks or potentiometers. Two digital inputs can be used to read switches.

The IQAN-TOC2 has a simple mechanical interface for calibration. With a preloaded personality from the factory, setup can be easily performed on the machine using a screwdriver. Adjustments possible include threshold, maximum output and slopes. The TOC2 may also be connected to a PC or Palm device and programmed using IQANdevelop software to change the functionality of the controller. This advanced feature allows the TOC2 to be used in more demanding applications.

The housing is designed to be rugged, but light and has a sealed, automotive AMP junior-power timer connector. The IQAN-TOC2 has a membrane to prevent condensation inside the housing. This controller is designed for the outdoor environment.

The TOC2 is made using selected components and conforms to strict international requirements.

Diagnostics: If an error is detected an LED on the top of the controller flashes a sequence to indicate the nature of the error.

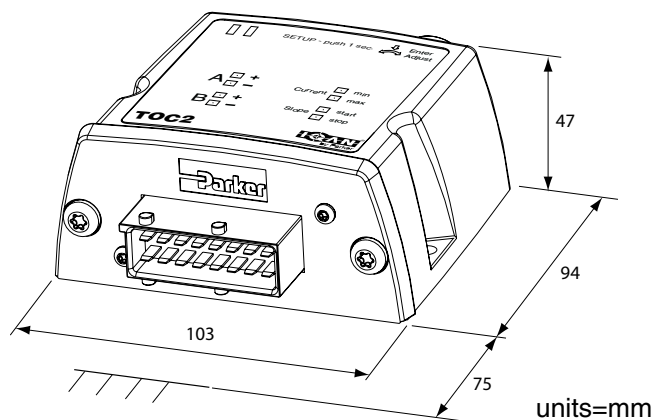
Description

IQAN-TOC2 (100 hz)

Ordering PN

5010028

Consult pricelist for other TOC2 factory preloaded personalities and their ordering part numbers.



units=mm



General

Weight (LSL)	0.22 Kg
Weight (LST)	0.04 Kg
Rated power supply (V_s)	5 VDC
Load resistive (min.)	1K ohm
Load capacitive (max.)	1 μ F
Current consumption	16 mA

Mechanical

Angle of movement (LSL)	$\pm 20^\circ$
Angle of movement (LST)	$\pm 30^\circ$
Expected life (operations)	5 million

Environment

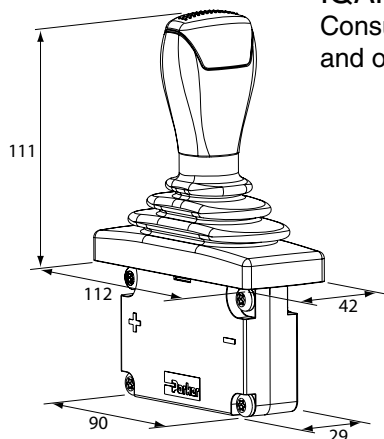
Operating temperature	-40 to +70 °C
Sealing above flange	IP65
Sealing with DN option	IP44
Sealing (LST)	IP66

Analog outputs

Active range (VDC out)	10%-90% V_s
Resolution	<2mV

LSL Options

Handle switch, top E1	V_{BAT} (+12V, +24V)
Mechanical detent DN	Neutral only
Solenoid detents	V_{BAT} (+24V)
Type L1	B(-)
Type L2	A(+) and B(-)
Type L3	75% B(-)



Application

The IQAN-LSL is a linear lever and the IQAN-LST is a linear, paddle style, mini-lever in the IQAN product group. These levers focus on compact design, weather resistance and safety.

Both levers are single-axis joysticks, 0.5 - 4.5 VDC, intended for the proportional control of one double-acting hydraulic function. The LSL has several options including a manual neutral detent, a switch in the top of the handle and solenoid detents at full stroke in either the B (minus) direction or both A (plus) and B (minus) directions. A solenoid detent at 75% in the B (minus) direction is also available. The LSL and LST can be mounted in the armrest or on the dashboard in mobile vehicles. they have comfortable grips and are easily actuated for good ergonomics.

The IQAN-LSL and LST are lightweight with small installation dimensions. The levers are covered with friction rubber on either side, to prevent the fingers from slipping and to provide a comfortable feel. Mounting screws are installed from underneath for a clean appearance of dashboard, panel or armrest.

The IQAN-LSL has an IP65 rating above the flange and the IQAN-LST with potted electronics, has an IP66 rating. The cables for the levers have a sealed, automotive type AMP junior-power timer connector. Both units are designed for the outdoor environment.

The IQAN-LSL and LST are spring centered, dual sensor devices. The dual sensors provide 0.5 - 4.5 VDC and 4.5 - 0.5 VDC outputs which allows error checking to meet high safety requirements. The optional switch in the top of the LSL handle can be used to detect operator presence. All inputs and outputs are protected against short circuit to ground.

Description

IQAN-LSL-E0-/-/-

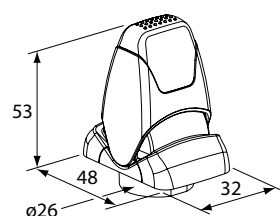
IQAN-LST

Consult datasheet and pricelist for other LSL options and ordering part numbers.

Ordering PN

20011365

20011381



units=mm



General

Weight	0.060 kg
Connectors	
B	Bosch (AMP Junior Timer)
D	Deutsch DT04-4P
Threaded interfaces	
B type only	1/4"-19 BSP with integral face seal
D type only	9/16"-18 UNF, SAE 6 with nitrile o-ring seal
Operating temperature	-40 to +125°C
Enclosure	IP65

Performance

Pressure range	0 - 35 bar, 0 - 500 bar
Total error (-40°C to 105°C) ¹⁾	Max 4.0 % FS
Total error (40°C to 80°C) ¹⁾	Max 1.0 % FS
Response time ²⁾	5.0 msec
Over pressure SP035	Max 100 bar
Over pressure SP500	Max 1050 bar
Burst pressure SP035	Min 150 bar
Burst pressure SP500	Min 1500 bar

1) Total accuracy includes non-linearity, hysteresis, repeatability and temperature effects.

2) Measured from initial value to output at 90%.

Electrical specifications

Output at FS ³⁾	4.5 VDC
Zero output ³⁾	0.5 VDC
Supply Voltage(Vs)	5.0 ±10% VDC ⁴⁾
Current supply	Max 12.5 mA
Load resistor	Min 5k ohm
Load capacitor	Max 0.1 µF

3) The output is ratiometric to supply voltage (Vs)

4) The max supply voltage with sensor operating is 6 Volt. (switch off app. 6.2 Volt)

Application

The IQAN-SP pressure transducers belong to the family of IQAN accessories developed to complement IQAN control systems. IQAN-SP is a range of 0-5V pressure transducers for mobile hydraulic applications. These transducers are available in two pressure ranges; 35 bar (500 psi) and 500 bar (7300 psi).

The IQAN-SP has stainless steel construction for strength. The sensor cells use thin film technology with no internal o-rings or fluid. The sensors are very robust and able to withstand heavy vibrations.

The design of the IQAN-SP has an EMI cap that separates the sensor electronics from the connector to ensure a high level of EMI protection.

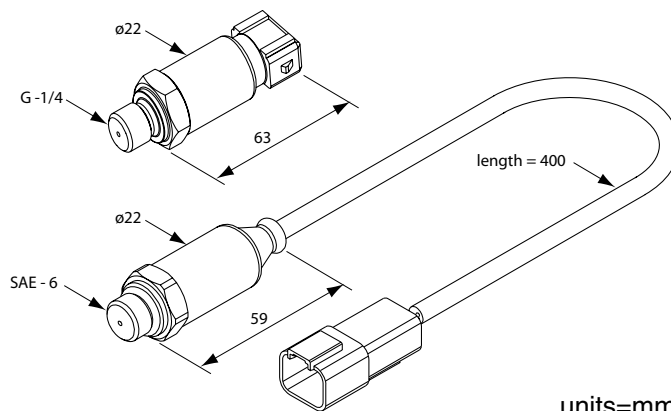
The two interface types of the IQAN-SP are well designed for the mobile hydraulics industry. The first type, -S, has a G1/4 thread. The hex of the transducer has an integrated face seal to eliminate sealing washers. The integral 3 pin connector is a sealed AMP Junior Power Timer type designed for automotive use. The second type, -D, has a SAE 6 (9/16"-18) thread. The connector on this type is a 4 pin Deutsch DT style and is attached via a short cable. Both connector types give the sensors IP65 protection for exposed outdoor applications.

Description

IQAN-SP035-B
IQAN-SP500-B
IQAN-SP035-D
IQAN-SP500-D

Ordering PN

5020026
5020027
2820008
2820009



units=mm



General

Weight	50 g
Operating temperature	-50 to 150°C
Protection	outdoor use
Pressure rating	
G (1/4 BSP)	Max 700 bar
M (M10)	Max 350 bar
U (SAE 6)	Max 1000 bar
Electrical	
Voltage supply VS	5±0.5 Vdc
Max 6 Vdc	
Current consumption	5.0 µA
	Max 7.5 µA
Total error (25°C)	1%
Total error (-40 to 150°C)	4%

Output

FS (150°C)	4.75 Vdc
Zero (-50°C)	0.25 Vdc
Span	4.50 Vdc
Ratiometricity	1%
Linearity	1% FS

Threaded interfaces

G	1/4"-19 BSP with integral face seal
M	M10 x 1, with integral face seal
U	9/16"-18 UNF, SAE 6 with nitrile o-ring seal

Connectors

B	Bosch (AMP Junior Timer)
D	Deutsch DT04-4P

Application

The IQAN-ST temperature transducer belongs to the family of IQAN accessories developed to complement IQAN control systems. IQAN-ST is a 0-5V output temperature transducer for mobile hydraulic applications. This transducer is available in three interface types; G1/4 BSP, M10 and 9/16"-18 UNF SAE 6. The G1/4 BSP and M10 sensors have an integral Bosch automotive connector. The SAE 6 sensor has a short cable-mounted Deutsch connector.

The IQAN-ST has stainless steel construction for strength. The PT100 sensor uses thin film technology with internal amplification. All versions of the sensor have high pressure capability. The IQAN-ST is very robust and able to withstand heavy vibrations.

The design of the IQAN-ST has an EMI cap that separates the sensor electronics from the connector. This ensures a high level of EMI protection.

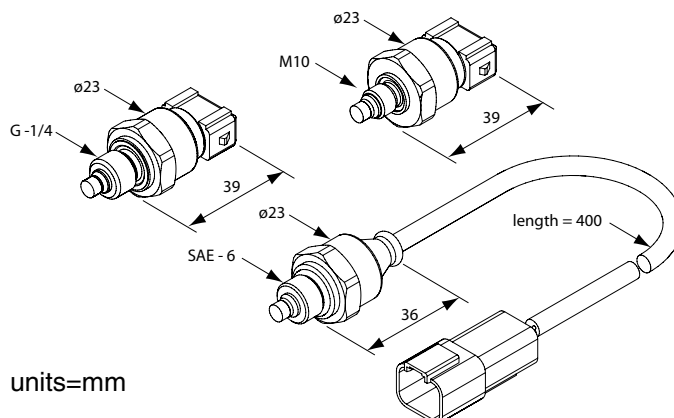
The IQAN-ST is well designed for the mobile hydraulics industry. The 3 pin integral Bosch connector is a sealed AMP Junior Timer type. The Deutsch connector is the DT04 type. Both connectors are designed for automotive use. These connectors give the sensor IP65 protection for exposed outdoor applications. The hex of the G1/4 BSP and M10 versions of the transducer have integrated face seals to eliminate loose sealing washers. The SAE 6 sensor type has a factory installed O-ring. These features provide for easy installation and removal, even in field conditions.

Description

IQAN-ST-G-B
IQAN-ST-M-B
IQAN-ST-U-D

Ordering PN

20073657
20073659
20073658



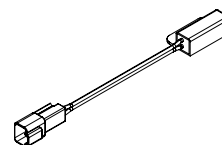
Ferrous proximity sensors

01695

FP2000 proximity sensor is a normally open, ferrous proximity sensor for mobile hydraulic applications and will sense ferrous objects.

cable length: 12 inches

connector: Deutsch DTM04-2P

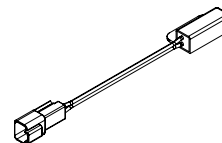


01699

FP3000 proximity sensor is a normally open, ferrous proximity sensor for mobile hydraulic applications and will sense ferrous objects.

cable length: 12 inches

connector: Deutsch DTM04-2P

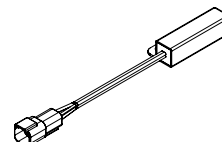


01703

FP4000 proximity sensor is a normally open, high power, ferrous proximity sensor for mobile hydraulic applications and will sense ferrous objects.

cable length: 12 inches

connector: Deutsch DTM04-4P



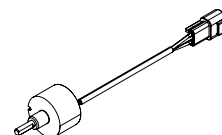
Rotary sensors

01705

RF50 rotary friction sensor is a 0-5Vdc output, non-contact, friction lock rotary control for mobile hydraulic applications.

cable length: 12 inches

connector: Deutsch DTM04-3P

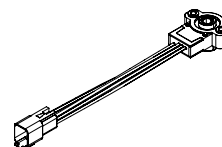


01707

RS70 rotary sensor is a 0-5Vdc, dual output, non-contact 170° rotary sensor for mobile hydraulic applications.

cable length: 12 inches

connector: Deutsch DTM04-6P

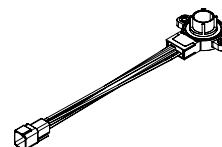


01708

RS60 rotary sensor is a 0-5Vdc, dual output, through hole coupling, non-contact 120° rotary sensor for mobile hydraulic applications.

cable length: 12 inches

connector: Deutsch DTM04-6P

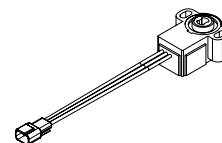


01709

RS52 rotary sensor is a 0-5Vdc, single output, non-contact, 90° rotary sensor for mobile hydraulic applications.

cable length: 12 inches

connector: Deutsch DTM04-3P



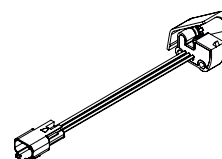
Linear sensors

01710

ADS50 sensor is a 25mm [1.0"] travel, lever actuated, 0-5Vdc linear output, non-contact, analog sensor for mobile hydraulic applications.

cable length: 12 inches

connector: Deutsch DTM04-3P



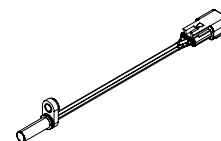
Speed sensors

01711

GS50 geartooth sensor is a digital output, non-contact, flange mount, ferrous sensor for mobile hydraulic applications.

cable length: 12 inches

connector: Deutsch DTM04-3P

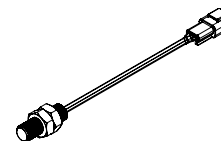


01712

GS60 geartooth sensor is a digital output, non-contact, threaded barrel mount, ferrous sensor for mobile hydraulic applications.

cable length: 12 inches

connector: Deutsch DTM04-3P



Tilt sensors

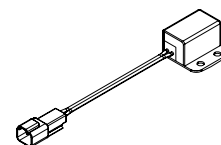
01715

RM50 rolling magnet switch is a one axis tilt switch for mobile hydraulic applications.

sensitivity: ± 10 degrees

cable length: 12 inches

connector: Deutsch DTM04-2P



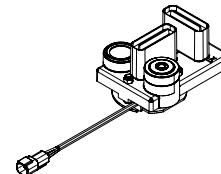
01716

ATS90 dual axis sensor is a two axis, 0-5Vdc, non-contact, Hall effect angle/tilt sensor for mobile hydraulic applications.

range: ± 10 degrees each axis

cable length: 12 inches

connector: Deutsch DTM04-4P



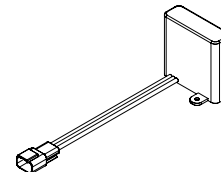
01759

ATS50 single axis sensor is a one axis, 0-5Vdc, non-contact, Hall effect angle/tilt sensor for mobile hydraulic applications.

range: ± 10 degrees

cable length: 12 inches

connector: Deutsch DTM04-3P



Acceleration sensors

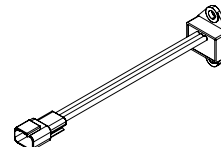
01767

ACC50 acceleration sensor is a 0-5 Vdc output accelerometer used to sense vibration, impact, tilt and motion for mobile hydraulic applications.

sensitivity: $\pm 1.5g$

cable length: 12 inches

connector: Deutsch DTM04-3P



Tools**5031061**

Medium duty service kit

contents: 3 crimping tools

1 5031057 pin box

1 5035003 extractor set

crimping tools not sold separately**5031057**

Pin box, JPT and MT parts

contents: qty AMP/Tyco PN

100 962945-2

100 963531-1

100 963530-1

100 963711-2

50 927779-1

25 927777-1

25 828922-1

25 929938-1

50 929940-1

25 2-963745-1

50 828904-1

25 828905-1

AMP parts not sold separately**5035003**

Set of 3 extraction tools, stamped

contents: 1 JPT extractor (yellow)

1 MT extractor (blue)

1 pin extractor (red)

stamped tools not sold separately**12000199**

Extraction tool, hardened alloy

contents: 1 MT extractor (blue)

**12003099**

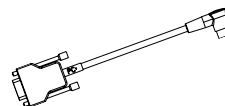
Extraction tool, hardened alloy

contents: 1 JPT extractor (yellow)

**Communication cables****5030024**

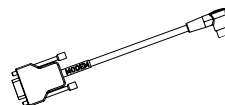
RS232-cable

length: 1,5 meters

use with: IQAN-MDM, -TOC8,
-TOC2 (TOC's require adapter)**5030080**

Remote diagnostics-cable

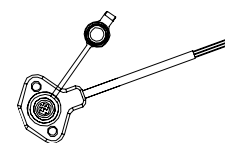
length: 1,5 meters

use with: IQAN-MDM, -TOC8,
-TOC2 (TOC's require adapter)**5030089**

Adapter-cable, panel mount

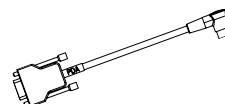
length: 0,4 meters

use with: IQAN-TOC8, -TOC2

**5030096**

Palm PDA-cable (for T, T2, T3)

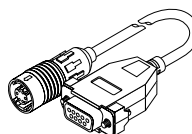
length: 1,5 meters

use with: IQAN-MDM, -TOC8,
-TOC2 (TOC's require adapter)**5030103**

RS232-cable

length: 1,5 meters

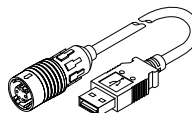
use with: IQAN-MDL

**5030110**

USB-cable

length: 1,5 meters

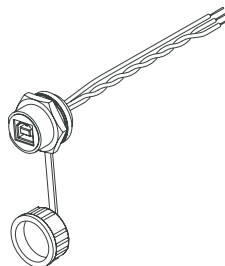
use with: IQAN-MDL

**5030124**

USB adapter-cable, panel mount

length: 0,4 meters

use with: IQAN-MC2, -MD3

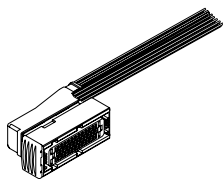


Consult "IQAN accessories" datasheet and pricelist for other accessory items and ordering part numbers.

Prototype installation cables

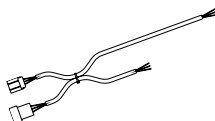
5030025

C1-cable, no seals
length: 2,5 meters
use with: IQAN-MDL



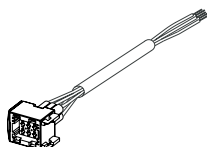
5030027

CAN/PWR/IO-cable, no seals
length: 2,5 meters
use with: IQAN-LL, -LM



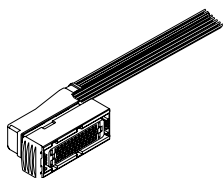
5030029

C1-cable, with seals
length: 2,5 meters
use with: IQAN-MDM



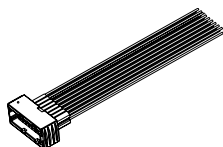
5030030

C1-cable, with seals
length: 2,5 meters
use with: IQAN-XA2, -XS2, -XT2,
-XP2, -TOC8, -MC2



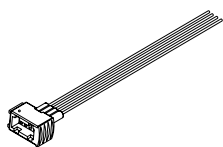
5030090

C1-cable, with seals
length: 2,5 meters
use with: IQAN-TOC2



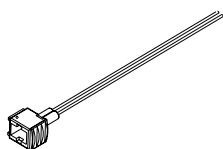
5030094

C1-cable, with seals
length: 2,5 meters
use with: IQAN-LST, -LSL



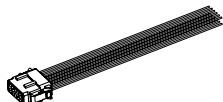
5030095

C2-cable, with seals
length: 2,5 meters
use with: IQAN-LSL options



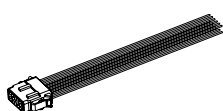
5030125

C1-cable, sealed
length: 2,5 meters
use with: IQAN-MD3



5030126

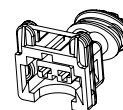
C2-cable, sealed
length: 2,5 meters
use with: IQAN-MD3



Connector kits

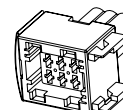
5031007

C1-connector, 2 position
use with: Temperature sensor



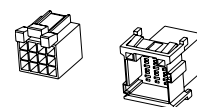
5031022

C1-connector, 6 position
use with: IQAN-MDM



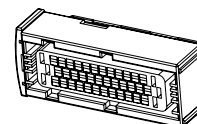
5031048

C1 and C2 -connectors, 12 pos.
use with: IQAN-LL, -LM



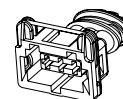
5031063

C1-connector, 42 position
use with: IQAN-XA2, -XS2, -XT2,
-XP2, -TOC8, -MDL, -MC2



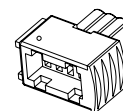
5031086

C1-connector, 3 position
use with: IQAN-SPxxx-S



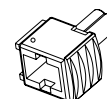
5031097

C1-connector, 4 position
use with: IQAN-LST, -LSL



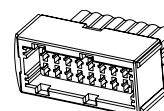
5031098

C2-connector, 2 position
use with: IQAN-LSL options



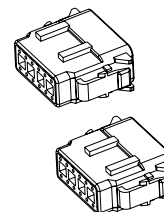
5031105

C1-connector, 16 position
use with: IQAN-TOC2
















20073081

C1-connector (grey), 12 position
C2-connector (black), 12 position
use with: IQAN-MD3



Consult "IQAN accessories" datasheet and pricelist for
other accessory items and ordering part numbers.

IQAN compatibility matrix

Software and CAN modules		CAN system Masters			Standalone units	
		 MDL	 MD3	 MDM	 MC2	 TOC8  TOC2
	IQAN design	✓	✓		✓	
	IQAN develop			✓	✓	✓
	XA2	✓	✓		✓	
	XS2	✓	✓		✓	
	XT2	✓	✓	✓	✓	
	Lx	✓	✓	✓	✓	
	XP2			✓		

Terms of Sale with Warranty Limitations

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The items described in this document and other documents or descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors are hereby offered for sale at prices to be established by Parker Hannifin Corporation, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any such items, when communicated to Parker Hannifin Corporation, its subsidiary or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

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2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

3. Delivery: Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. Warranty: Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from Parker Hannifin Corporation. **THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED. NOTWITHSTANDING THE FOREGOING, THERE ARE NOWARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGNS OR SPECIFICATIONS.**

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6. Changes, Reschedules and Cancellations: Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. Buyer's Property: Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property, Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

9/91-P



Parker's Motion & Control Technologies

At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion or control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further information call 800 272 7537



AEROSPACE

Key Markets

- Aircraft engines
- Business & general aviation
- Commercial transports
- Land-based weapons systems
- Military aircraft
- Missiles & launch vehicles
- Regional transports
- Unmanned aerial vehicles

Key Products

- Flight control systems & components
- Fluid conveyance systems
- Fluid metering delivery & atomization devices
- Fuel systems & components
- Hydraulic systems & components
- Inert nitrogen generating systems
- Pneumatic systems & components
- Wheels & brakes



CLIMATE CONTROL

Key Markets

- Agriculture
- Air conditioning
- Food, beverage & dairy
- Life & medical sciences
- Precision cooling
- Processing
- Transportation

Key Products

- CO₂ controls
- Electronic controllers
- Filter driers
- Hand shut-off valves
- Hose & fittings
- Pressure regulating valves
- Refrigerant distributors
- Safety relief valves
- Solenoid valves
- Thermostatic expansion valves



ELECTROMECHANICAL

Key Markets

- Aerospace
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Paper machinery
- Plastics machinery & converting
- Primary metals
- Semiconductor & electronics
- Textile
- Wire & cable

Key Products

- AC/DC drives & systems
- Electric actuators, gantry robots & slides
- Electrohydraulic actuation systems
- Electromechanical actuation systems
- Human machine interface
- Linear motors
- Stepper motors, servo motors, drives & controls
- Structural extrusions



FILTRATION

Key Markets

- Food & beverage
- Industrial machinery
- Life sciences
- Marine
- Mobile equipment
- Oil & gas
- Power generation
- Process
- Transportation

Key Products

- Analytical gas generators
- Compressed air & gas filters
- Condition monitoring
- Engine air, fuel & oil filtration & systems
- Hydraulic, lubrication & coolant filters
- Process, chemical, water & microfiltration filters
- Nitrogen, hydrogen & zero air generators



FLUID & GAS HANDLING

Key Markets

- Aerospace
- Agriculture
- Bulk chemical handling
- Construction machinery
- Food & beverage
- Fuel & gas delivery
- Industrial machinery
- Mobile
- Oil & gas
- Transportation
- Welding

Key Products

- Brass fittings & valves
- Diagnostic equipment
- Fluid conveyance systems
- Industrial hose
- PTFE & PFA hose, tubing & plastic fittings
- Rubber & thermoplastic hose & couplings
- Tube fittings & adapters
- Quick disconnects



HYDRAULICS

Key Markets

- Aerospace
- Aerial lift
- Agriculture
- Construction machinery
- Forestry
- Industrial machinery
- Mining
- Oil & gas
- Power generation & energy
- Truck hydraulics

Key Products

- Diagnostic equipment
- Hydraulic cylinders
- Hydraulic motors & pumps
- Hydraulic systems
- Hydraulic valves & controls
- Power take-offs
- Rubber & thermoplastic hose & couplings
- Tube fittings & adapters
- Quick disconnects



PNEUMATICS

Key Markets

- Aerospace
- Conveyor & material handling
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Transportation & automotive

Key Products

- Air preparation
- Brass fittings & valves
- Manifolds
- Pneumatic accessories
- Pneumatic actuators & grippers
- Pneumatic valves & controls
- Quick disconnects
- Rotary actuators
- Rubber & thermoplastic hose & couplings
- Structural extrusions
- Thermoplastic tubing & fittings
- Vacuum generators, cups & sensors



PROCESS CONTROL

Key Markets

- Chemical & refining
- Food, beverage & dairy
- Medical & dental
- Microelectronics
- Oil & gas
- Power generation

Key Products

- Analytical sample conditioning products & systems
- Fluoropolymer chemical delivery fittings, valves & pumps
- High purity gas delivery fittings, valves & regulators
- Instrumentation fittings, valves & regulators
- Medium pressure fittings & valves
- Process control manifolds



SEALING & SHIELDING

Key Markets

- Aerospace
- Chemical processing
- Consumer
- Energy, oil & gas
- Fluid power
- General industrial
- Information technology
- Life sciences
- Military
- Semiconductor
- Telecommunications
- Transportation

Key Products

- Dynamic seals
- Elastomeric o-rings
- EMI shielding
- Extruded & precision-cut, fabricated elastomeric seals
- Homogeneous & inserted elastomeric shapes
- High temperature metal seals
- Metal & plastic retained composite seals
- Thermal management

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