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# IQAN

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Simplicity now, not in the future

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.

IQANdesign and IQANdevelop offer system designers a complete set of tools for building competitive features and functionality into their hydraulic machine controls. IQANdesign and IQANdevelop are high-level graphical software tools that simplify application design and dramatically reduce development time by allowing the machine designer to program IQAN.

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:

Mobility
  Hardware designed and tested for mobile hydraulic equipment.

Simplicity
  Implement complex machine functionality without any specialized programming knowledge.

Time to Market
  Reduce development time using IQAN programming tools and standard hardware.

Machine management
  Connection and communication capabilities for complete machine management.
Application
IQANdesign is a high level graphical design tool which dramatically simplifies application development for your mobile machine. This software is used with the newest master units in the IQAN product family, such as the IQAN-MD3, -MDL and -MC2. Simulation of the control system is easy and takes place in parallel with the programming of desired machine functionality.

With IQANdesign you create an application file that consists of information about the system’s modules, busses, addresses, inputs, outputs and internal channels. By connecting channels, creating functions and adding modules you can easily create your machine’s application.

In IQANdesign there are no hard and fast rules on what to do first. You can start to design the functionality by creating channels and conditions or if you prefer, you can add the modules you expect to use and then connect the channels. Choose the method that suits you the best.

IQANdesign is an excellent tool for measuring and troubleshooting IQAN systems. Remote fault analysis and troubleshooting is easily handled using IQAN software. This also allows easy updates and tuning of your machine. The Simulate for IQANdesign plug-in may be added to the basic software to perform a virtual test of your application before installing it on the machine.

Description
Ordering PN
IQANdesign 20016293
Simulate for IQANdesign 20016294

Contents
When ordering IQANdesign, the following items are included:

• IQANdesign software CD-ROM
• 1 licence
• 1 USB cable

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.

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.
Contents
When ordering IQANrun, the following items are included:

• IQANrun software CD-ROM
• 1 licence
• 1 USB cable

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

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
IQANrun is a high level service tool which dramatically simplifies setup during production or after sale service for your IQAN controlled mobile machine. This software is used with the newest master units in the IQAN product family, such as the IQAN-MD3, -MDL and -MC2.

Using our design software tool, IQANdesign, you prepare your machine application for IQANrun by creating measure groups, adjustment groups and logs. These features are then easily accessed with the IQANrun software by production employees and service personnel to fine tune and troubleshoot your machine's operation.

IQANrun is an excellent tool for measuring and troubleshooting IQAN systems. Remote fault analysis and troubleshooting is easily handled using this software. IQANrun also allows easy updates and tuning of your machine.

By connecting a modem to your PC, you can use IQANrun to communicate with a remote IQAN system. Using a modem, it is possible to update applications, measure and do all the things you can do when communicating with a local system via a serial or USB port.

Description
IQANrun

Ordering PN
20070897
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.

Description
IQANdevelop PRO 20005607
IQANdevelop Change 20005606
Master units, IQANdesign platform

**IQAN-MD3**

### 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” transflective 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

**Ordering PN**

IQAN-MD3

**20072409**

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### Technical Information

#### General

- **Weight**: 0.3 Kg
- **Operating temperature**: -30 to +60 °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)
  - **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.
Master units, IQANdesign platform

IQAN-MDL

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” transflective 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

IQAN-MDL

20016753
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

<table>
<thead>
<tr>
<th>IQAN-MC2</th>
<th>Ordering PN</th>
</tr>
</thead>
<tbody>
<tr>
<td>20070899</td>
<td></td>
</tr>
</tbody>
</table>

### Technical information

#### 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**: USB 1.1

#### Outputs
- **Proportional outputs**
  - **Type current mode**: current - closed-loop
  - **Type 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
  - **Signal range (position mode)**: 0 - 20000 Hz
- **Digital inputs**
  - **Signal high**: 4 VDC - V_BAT
  - **Signal low**: 0 - 1 VDC

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Catalog HY14-1825/US
Master units, IQANdesign platform
IQAN-MC2

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Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio USA
Application
The IQAN-MDM works as the central unit, together with expansion modules in an IQAN control system. The MDM works both as a master and a display unit. It is possible to download a sample application from our website for crane control. This application can easily be modified, by means of IQANdevelop software, to include functions such as; overload protection, end position damping, envelope control etc.

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.

The MDM has a back-lit graphic LCD. The display also contains a real time clock, an alarm output and can present text in 10 different languages.

IQAN-MDM is designed for in-cab as well as outdoor use. IQAN-MDM is connected to other modules via a CAN bus which makes data exchange more efficient, simplifies installation and increases noise immunity. The unit has an RS232 port for communication with a PC.

Description
Ordering PN
IQAN-MDM
5010010

<table>
<thead>
<tr>
<th>General</th>
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<tbody>
<tr>
<td>Weight</td>
<td>0,2 kg</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-30 to +70 °C</td>
</tr>
<tr>
<td>(reduced display update)</td>
<td>(-30 to 0 °C)</td>
</tr>
<tr>
<td>Protection</td>
<td>outdoor use</td>
</tr>
<tr>
<td>Voltage supply</td>
<td>11 - 32 VDC</td>
</tr>
<tr>
<td>Current consumption</td>
<td>max 0,1 A (28 VDC), max 0,18 A (14 VDC)</td>
</tr>
<tr>
<td>Data interface</td>
<td>Parker ICP (IQAN CAN Protocol)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Display</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>LED back-lit LCD</td>
</tr>
<tr>
<td>Resolution</td>
<td>202x32 pixels</td>
</tr>
<tr>
<td>Digital output</td>
<td>1 pcs</td>
</tr>
<tr>
<td>Number</td>
<td>high side switch</td>
</tr>
<tr>
<td>Type</td>
<td>max 1,2 Adc</td>
</tr>
<tr>
<td>Output</td>
<td></td>
</tr>
</tbody>
</table>

| Serial communication             |       |
| Interface                        | RS232 “handshake” |
| Bit rate                         | 57,6 Kbit/s |
| Protocol                         | PARKER IDP |
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

<table>
<thead>
<tr>
<th>General</th>
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<tbody>
<tr>
<td>Weight</td>
<td>0.7 Kg</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40 to +70 °C</td>
</tr>
<tr>
<td>Protection</td>
<td>outdoor use</td>
</tr>
<tr>
<td>Voltage supply</td>
<td>11 - 32 VDC</td>
</tr>
<tr>
<td>Current consumption (idle)</td>
<td>180 mA (28 VDC)</td>
</tr>
<tr>
<td></td>
<td>170 mA (14 VDC)</td>
</tr>
<tr>
<td>Data interface</td>
<td>Parker ICP</td>
</tr>
<tr>
<td></td>
<td>(IQAN CAN Protocol)</td>
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<table>
<thead>
<tr>
<th>Outputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportional outputs</td>
<td></td>
</tr>
<tr>
<td>Type current mode</td>
<td>current - closed-loop</td>
</tr>
<tr>
<td>PWM mode</td>
<td>voltage - open-loop</td>
</tr>
<tr>
<td>Signal range</td>
<td>100 - 2000 mA</td>
</tr>
<tr>
<td>Dither frequency</td>
<td>25 - 333 Hz</td>
</tr>
<tr>
<td>Resolution</td>
<td>1 mA</td>
</tr>
<tr>
<td>Digital outputs</td>
<td>high side switch</td>
</tr>
<tr>
<td>Max load</td>
<td>2 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage inputs</td>
<td></td>
</tr>
<tr>
<td>Signal range</td>
<td>0 - 5 VDC</td>
</tr>
<tr>
<td>Resolution</td>
<td>5 mV</td>
</tr>
<tr>
<td>Frequency inputs</td>
<td></td>
</tr>
<tr>
<td>Signal range (speed mode)</td>
<td>2 - 30000 Hz</td>
</tr>
<tr>
<td>(position mode)</td>
<td>0 - 30000 Hz</td>
</tr>
<tr>
<td>Quadrature inputs</td>
<td></td>
</tr>
<tr>
<td>Signal range (speed mode)</td>
<td>2 - 30000 Hz</td>
</tr>
<tr>
<td>(position mode)</td>
<td>0 - 30000 Hz</td>
</tr>
<tr>
<td>Digital inputs</td>
<td></td>
</tr>
<tr>
<td>Signal high</td>
<td>4 VDC - $V_{BAT}$</td>
</tr>
<tr>
<td>Signal low</td>
<td>0 - 1 VDC</td>
</tr>
</tbody>
</table>
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
Ordering PN
IQAN-XS2 5010017
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

<table>
<thead>
<tr>
<th>Ordering PN</th>
<th>5010018</th>
</tr>
</thead>
</table>

**General**
- Weight: 0.7 Kg
- Operating temperature: -40 to +70 °C
- 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

---

Catalog HY14-1825/US

Technical information

Expansion units, IQANdesign or IQANdevelop

IQAN-XT2
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

<table>
<thead>
<tr>
<th>Description</th>
<th>Ordering PN</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQAN-LL-2U (no handle)</td>
<td>20005961</td>
</tr>
<tr>
<td>IQAN-LM-2A (stick handle)</td>
<td>20005963</td>
</tr>
</tbody>
</table>

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

Technical information

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

<table>
<thead>
<tr>
<th>Axis Sensors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>max 3 pcs, inductive</td>
</tr>
<tr>
<td>Resolution</td>
<td>9 bit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neutral Position Detection</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal</td>
<td>IR-sensor, on/off</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital Inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>10 pcs, 4 internal, 6 external (differs according to handle)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal range</td>
<td>0 – 5 VDC</td>
</tr>
<tr>
<td></td>
<td>0 – 32 VDC</td>
</tr>
<tr>
<td>Active range</td>
<td>&quot;0&quot; = 0,0 – 1,0 VDC, &quot;1&quot; = 2,0 – 32,0 VDC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analog Inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>2 pcs</td>
</tr>
<tr>
<td>Signal range</td>
<td>0 – 5 VDC</td>
</tr>
<tr>
<td></td>
<td>0 – 32 VDC</td>
</tr>
<tr>
<td>Active range</td>
<td>0,5 – 4,5 VDC</td>
</tr>
<tr>
<td>Resolution</td>
<td>5 mV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital Outputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>1 pc</td>
</tr>
<tr>
<td>(takes place of 1 digital input)</td>
<td></td>
</tr>
<tr>
<td>Signal</td>
<td>200 mA</td>
</tr>
</tbody>
</table>

Expansion units, IQANdesign or IQANdevelop

IQAN-LL and IQAN-LM
Application
IQAN-XP2 is the first 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.

New types of I/O such as PWM outputs increase the flexibility of the module. Digital outputs now have new 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**

| 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) | 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 | 4/2 |
| Number | 4/2 |
| Signal range | 0 - 5 VDC |
| Resolution | 5 mV |
| Frequency range | 1-30000 Hz |
Stand-alone units, IQANdevelop platform

IQAN-TOC8

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

Ordering PN

IQAN-TOC8  5010024
Stand-alone units, IQANdevelop platform

**IQAN-TOC2**

### 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

#### Ordering PN

IQAN-TOC2 (100 Hz) 5010028

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

---

### General

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>0.2 Kg</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40 to +70 °C</td>
</tr>
<tr>
<td>Protection</td>
<td>outdoor use</td>
</tr>
<tr>
<td>Voltage supply</td>
<td>9 - 34 VDC</td>
</tr>
<tr>
<td>Current consumption (idle)</td>
<td>60 mA (28 VDC)</td>
</tr>
<tr>
<td></td>
<td>40 mA (14 VDC)</td>
</tr>
<tr>
<td>Data interface</td>
<td>mechanical encoder or RS232 (using IQANdevelop)</td>
</tr>
<tr>
<td>VREF output</td>
<td>4.9 - 5.1 VDC</td>
</tr>
<tr>
<td></td>
<td>30 mA (28 VDC)</td>
</tr>
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### Outputs

<table>
<thead>
<tr>
<th>Current / PWM outputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>2 double</td>
</tr>
<tr>
<td>Type current mode</td>
<td>current - closed loop</td>
</tr>
<tr>
<td></td>
<td>voltage - open loop</td>
</tr>
<tr>
<td>Min. threshold</td>
<td>50 mA</td>
</tr>
<tr>
<td>Max. load</td>
<td>3000 mA</td>
</tr>
<tr>
<td>Dither frequency</td>
<td>25 - 333 Hz</td>
</tr>
<tr>
<td>Resolution</td>
<td>1 mA</td>
</tr>
</tbody>
</table>

### Inputs

<table>
<thead>
<tr>
<th>Voltage inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>2</td>
</tr>
<tr>
<td>Signal range</td>
<td>0 - 5 VDC</td>
</tr>
<tr>
<td>Resolution</td>
<td>5 mV</td>
</tr>
<tr>
<td>Digital inputs</td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>2</td>
</tr>
<tr>
<td>Signal high</td>
<td>4 VDC - V\text{BAT}</td>
</tr>
<tr>
<td>Signal low</td>
<td>0 - 1 VDC</td>
</tr>
</tbody>
</table>
Technical information

Components, analog levers
IQAN-LSL and IQAN-LST

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
Ordering PN
IQAN-LSL-E0/-/-/  20011365
IQAN-LST  20011381
Consult datasheet and pricelist for other LSL options and ordering part numbers.

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 µF
Current consumption  16 mA

Mechanical
Angle of movement (LSL)  ±20°
Angle of movement (LST)  ±30°
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
Mechanical detent DN
Solenoid detents
Type L1
Type L2
Type L3

Components, analog levers
IQAN-LSL and IQAN-LST

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.

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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
Ordering PN
IQAN-LSL-E0/-/-/  20011365
IQAN-LST  20011381
Consult datasheet and pricelist for other LSL options and ordering part numbers.

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 µF
Current consumption  16 mA

Mechanical
Angle of movement (LSL)  ±20°
Angle of movement (LST)  ±30°
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
Mechanical detent DN
Solenoid detents
Type L1
Type L2
Type L3
Technological Information

**IQAN-SP**

**Application**

The IQAN-SP pressure transducers belong to the family of IQAN accessories developed to complement IQAN control systems. IQAN-SP is a new 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**

<table>
<thead>
<tr>
<th>Description</th>
<th>Ordering PN</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQAN-SP035-S</td>
<td>5020026</td>
</tr>
<tr>
<td>IQAN-SP500-S</td>
<td>5020027</td>
</tr>
<tr>
<td>IQAN-SP035-D</td>
<td>2820008</td>
</tr>
<tr>
<td>IQAN-SP500-D</td>
<td>2820009</td>
</tr>
</tbody>
</table>

**General**

- **Weight**: 0.060 kg
- **Connector**: AMP JPT (-S), Deutsch DT (-D)
- **Pressure connection**: DIN G1/4” (-S), SAE 6, 9/16”-18 (-D)
- **Operating temperature**: -40 to +125°C
- **Enclosure**: IP65

**Performance**

- **Pressure range**: 0 - 35 bar, 0 - 500 bar
- **Total error (-40°C to 105°C)**: Max 4.0 % FS
- **Total error (40°C to 80°C)**: Max 1.0 % FS
- **Response time**: 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**: 4.5 VDC
- **Zero output**: 0.5 VDC
- **Supply Voltage(Vs)**: 5.0 ±10% VDC
- **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)
**Tools**

**5031061**
Medium duty service kit
contents: 3 crimping tools
1 5031057 pin box
1 5035003 extractor set
cramping 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)

**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

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Length</th>
<th>Use With</th>
</tr>
</thead>
<tbody>
<tr>
<td>5030025</td>
<td>C1-cable, no seals</td>
<td>2.5m</td>
<td>IQAN-MDL</td>
</tr>
<tr>
<td>5030027</td>
<td>CAN/PWR/IO-cable, no seals</td>
<td>2.5m</td>
<td>IQAN-LL, -LM</td>
</tr>
<tr>
<td>5030029</td>
<td>C1-cable, with seals</td>
<td>2.5m</td>
<td>IQAN-MDM</td>
</tr>
<tr>
<td>5030030</td>
<td>C1-cable, with seals</td>
<td>2.5m</td>
<td>IQAN-XA2, -XS2, -XT2, -XP2, -TOC8, -MC2</td>
</tr>
<tr>
<td>5030090</td>
<td>C1-cable, with seals</td>
<td>2.5m</td>
<td>IQAN-TOC2</td>
</tr>
<tr>
<td>5030094</td>
<td>C1-cable, with seals</td>
<td>2.5m</td>
<td>IQAN-LST, -LSL</td>
</tr>
<tr>
<td>5030095</td>
<td>C2-cable, with seals</td>
<td>2.5m</td>
<td>IQAN-LSL options</td>
</tr>
<tr>
<td>5030125</td>
<td>C1-cable, sealed</td>
<td>2.5m</td>
<td>IQAN-MD3</td>
</tr>
<tr>
<td>5030126</td>
<td>C2-cable, sealed</td>
<td>2.5m</td>
<td>IQAN-MD3</td>
</tr>
</tbody>
</table>

### Connector kits

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Use With</th>
</tr>
</thead>
<tbody>
<tr>
<td>5031007</td>
<td>C1-connector, 2 position</td>
<td>Temperature sensor</td>
</tr>
<tr>
<td>5031022</td>
<td>C1-connector, 6 position</td>
<td>IQAN-MDM</td>
</tr>
<tr>
<td>5031048</td>
<td>C1 and C2 connectors, 12 pos.</td>
<td>IQAN-LL, -LM</td>
</tr>
<tr>
<td>5031063</td>
<td>C1-connector, 42 position</td>
<td>IQAN-XA2, -XS2, -XT2, -XP2, -TOC8, -MDL, -MC2</td>
</tr>
<tr>
<td>5031086</td>
<td>C1-connector, 3 position</td>
<td>IQAN-SPxxx-S</td>
</tr>
<tr>
<td>5031097</td>
<td>C1-connector, 4 position</td>
<td>IQAN-LST, -LSL</td>
</tr>
<tr>
<td>5031098</td>
<td>C2-connector, 2 position</td>
<td>IQAN-LSL options</td>
</tr>
<tr>
<td>5031105</td>
<td>C1-connector, 16 position</td>
<td>IQAN-TOC2</td>
</tr>
<tr>
<td>20072406</td>
<td>C1-connector, 12 position</td>
<td>IQAN-MD3</td>
</tr>
<tr>
<td>20072407</td>
<td>C2-connector, 12 position</td>
<td>IQAN-MD3</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Software and CAN modules</th>
<th>CAN system Masters</th>
<th>Standalone units</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IQAN design</td>
<td>MDL</td>
<td>MD3</td>
<td>MC2</td>
</tr>
<tr>
<td>IQAN develop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XA2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>XS2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>XT2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Lx</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>XP2</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>FEATURES</td>
<td>ADVANTAGES</td>
<td>BENEFITS</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>Mobility</td>
<td>Tested for rugged mobile environments.</td>
<td>Hardware tested to mobile standards and designed to control proportional hydraulics increases the machine's effectiveness.</td>
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<td></td>
<td>Integrated mobile interfaces.</td>
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<tr>
<td>Simplicity</td>
<td>User-friendly, graphical software tools.</td>
<td>User programmable tools reduce personnel costs. Specialized programmers are not needed.</td>
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<tr>
<td></td>
<td>Graphical, easy to use diagnostic tools.</td>
<td>Software simulation reduces testing time and increases safety.</td>
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<tr>
<td></td>
<td>Software simulation.</td>
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<tr>
<td>Time to market</td>
<td>Product development based on standard hardware.</td>
<td>Standard, tested hardware for mobile environments reduces development time.</td>
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<tr>
<td></td>
<td>Easy to use graphical programming tools.</td>
<td>User-friendly software tools reduce programming time.</td>
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<tr>
<td>Machine management</td>
<td>Easy to use fault finding and diagnostic tools.</td>
<td>Clear text error messages, error logging and diagnostics reduce field personnel skill levels. Technicians do not need to be engineers.</td>
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<tr>
<td></td>
<td>Data storage and transfer.</td>
<td>Modem connection allows remote diagnostics and application updates to eliminate service trips.</td>
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<tr>
<td></td>
<td>Remote diagnostics via modem.</td>
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<tr>
<td>Life Cycle</td>
<td>Cost</td>
<td>Savings</td>
<td></td>
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<td>------------------</td>
<td>----------------------------------------------------------------------</td>
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<tr>
<td>Development</td>
<td>Design engineering, developing a controller program, prototyping and testing are typically huge investments of time and resources. Maintaining a dedicated programming staff (or hiring temporarily) is also expensive.</td>
<td>IQAN hardware is tested to mobile standards, user programmable software and software simulation reduces development and test time. With IQAN, no specialized programmers are needed.</td>
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<tr>
<td>Production</td>
<td>Many controllers that are put into real world conditions are not reliable enough to build consistently in serial production, resulting in delays and redesigns. Others may work, but are difficult to optimize for the task at hand.</td>
<td>IQAN's reliable, robust hardware withstands the rigors of outdoor use and enhance production. Our hardware is designed for mobile machine functions and is easy to tune; to make every machine more effective and productive.</td>
<td></td>
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<tr>
<td>After-sale support</td>
<td>Travel costs to service machines and the parts and labor involved make field service calls expensive. Training a field service force is also a costly undertaking, especially when they need to be Electrical Engineers to deal with the intricacies of a control system.</td>
<td>IQAN modem connectivity allows remote diagnostics and application updates to reduce or eliminate service trips. Our reliable, modular hardware decreases parts and labor costs. Clear text error messages, error logging and diagnostics reduce field personnel skill levels. Technicians do not need to be engineers.</td>
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<tr>
<td>Machine owner/operator</td>
<td>Unreliable and difficult to diagnose systems increase downtime and reduce overall productivity.</td>
<td>IQAN is designed and tested for rugged mobile environments. Easy to use graphical diagnostic tools and graphical operator interfaces reduce diagnostic time.</td>
<td></td>
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</tbody>
</table>
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10. Indemnity For Infringement of Intellectual Property Rights: Seller shall not be liable for or be responsible for any infringements or claims of 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 any such action brought against Buyer based on an allegation that any 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.

11. Force Majeure: Seller does not assume the risk of and shall not be liable for any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

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 laws 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
### Extensive Hydraulic Product Offering

<table>
<thead>
<tr>
<th>Accumulators</th>
<th>Compact Hydraulics</th>
<th>Cylinders</th>
<th>Electronics/Remote Controls</th>
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<td>Piston, bladder and diaphragm type accumulators, gas bottles and KleenVent reservoir isolators.</td>
<td>Self-contained with a motor, gear pump, reservoir, internal valving, load hold checks and relief valves.</td>
<td>Standard and custom hydraulic cylinders for industrial and mobile applications.</td>
<td>Parker’s unique IQAN approach combines sturdy, well-tested hardware with intelligent, flexible computing power.</td>
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<tr>
<th>Filtration</th>
<th>Integrated Hydraulic Circuits</th>
<th>Motors</th>
<th>Power Take Off</th>
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<td>Pressure and return line filters enhances machine life, reduces maintenance and lowers costs.</td>
<td>Solutions for complex circuits that include threaded cartridge valves integrated into a single manifold.</td>
<td>Full line of high and low speed motors provides power up to 15,000 in-lbs of torque.</td>
<td>Parker Chelsea leads the industry for engineering, innovation and performance in auxiliary power systems.</td>
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<tr>
<th>Power Units</th>
<th>Pumps</th>
<th>Rotary Actuator</th>
<th>Valves and Controls</th>
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</tr>
<tr>
<td>The most complete line of standard, pre-engineered, cataloged hydraulic power units in the industry.</td>
<td>Broad line of energy-efficient hydraulic pumps that includes piston, vane and gear pumps.</td>
<td>Industry leader in the design and manufacture of hydraulic rack and pinion, and vane style rotary actuators.</td>
<td>Hydraulic valves for virtually every hydraulic equipment application, from simple to precise control.</td>
</tr>
</tbody>
</table>

Covering the Industrial, Mobile and Truck markets, each catalog is paired with an interactive CD. Call for your comprehensive guides today. 1-800-CParker