



Electronic Control Systems IQAN[®] System Products

Catalog MSG33-1825/US
North American Product Offering



ENGINEERING YOUR SUCCESS.

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SAFETY

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Description

IQANdesign
IQANrun
IQANscript

Requirements

CPU	PC compatible, Pentium® II 233 MHz or better
RAM	minimum 256 Mbyte (512 Mbyte recommended)
HD	100 Mbyte storage space available
Ports	RS232 or USB port, Ethernet
Display	XVGA (1280x1024 recommended)
Software	Windows® 7, 8, 10

Upgrade

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

Application

The IQAN software covers all phases of a machine's life cycle, from development through production to after sales.

There are three different softwares available for purchase; IQANdesign, IQANrun and IQANscript. Supporting softwares IQANsimulate and IQANanalyze are available free of charge.

Design

The main philosophy behind the IQAN Design software is that the OEM, with their extensive knowledge of their machine, should be able to write the desired machine functionality directly, without having programming experience.

IQAN Design is a high level graphical design tool which simplifies application development for your mobile machine and reduces development time. This tool is mainly used for system layout and machine function design.

Run

IQAN Run may be used by the service department and can be adapted to feature machine-specific procedures for maintenance, fault finding and web supported machine upgrades, while the machine owner can access spare parts manuals, maintenance videos, service intervals and service suggestions.

IQAN Run software is a user-friendly service, production and machine owner tool which includes a powerful, graphical measure capability and simplifies machine tuning for increased productivity.

Script

The script concept was developed to help OEM production departments to create routines for testing, tuning, setting options, logging, delivery sheets, and much more.

With IQAN Script you create scripts using simple drag and drop operations. Each script is a sequence of actions that can be executed in IQAN Run. A wide range of script actions are available to build scripts for different purposes.

Simulate

IQAN Simulate is a free simulation tool used with IQAN Design, which simplifies function test, validation and reduces development time. It simulates all of the hardware modules in an IQAN Design application. Software simulation is a safer way to test new applications than on an actual machine. Simulate may also be used with Script for debugging your scripts before sending them to the production floor or field.

Analyze

IQANanalyze is a free general-purpose CAN-bus analyzer used with IQAN Design. It may be installed to view CAN traffic on the bus.

Order software on-line at www.iqan.se/store

IQAN-MD4

IQAN System Products



General

Weight (MD4-7)	0.93 kg
Weight (MD4-5)	0.67 kg
Weight (MD4-10)	1.5 kg
Operating temperature	-30 °C to 70 °C
Storage temperature	-40 °C to 85 °C
Protection	IP65
Voltage supply	9-32 Vdc
Current consumption (idle)	300 mA (28Vdc) 600 mA(14Vdc)
CE marking	2004/108/EC

Performance

Processor	ARM Cortex-A8, (800 MHz)
Memory	2 Gbyte Flash, 256 Mbyte SDRAM
Logging	64 Mb
Cycle time	10 to 100 ms
Software tools	IQANdesign platform

Communication interface

CAN (ISO 11898)	4 (2) ²
Protocols	ICP, SAE J1939, generic
Ethernet 100Base-Tx	2 (1) ^{1,2}

Display

Touch Interface	PCAP ²
7" (18 cm) display	16:9, 800x480 pixels
5.7" (14 cm) display	4:3, 640x480 pixels
10.1" (26 cm) display	4:3, 800x600 pixels

Connection

Electrical connection	2x Deutsch DTM, 12 pos
Ethernet	2 x M12, D-code, 4 pos

Outputs

Digital outputs	4 ³
Type	Low side
Max load, 1 output	300 mA
Max load, all outputs	850 mA

Inputs

Voltage inputs	2 ³
Signal range	0 - 5 Vdc, 12 bit
Digital inputs	10 ³
Encoder input	1 ³
Signal range	0 - 500 Hz, 50/50 signal

- 1) Ethernet port A dedicated for PC diagnostics.
- 2) Depending on configuration.
- 3) The outputs and inputs share the same physical pins. The user defines the channels/pins with IQANdesign.

Application

The IQAN-MD4 is a family of master display units, fully compliant with the IQANdesign platform system. The units have full graphical, diagnostic and CAN gateway capability and are used together with the easy to use IQAN programming tools.

IQAN-MD4-7 is offered with a 7" (18 cm) display with touch screen, IQAN-MD4-10 has a 10.4" (26 cm) display with touch screen and the IQAN-MD4-5 has a 5.7" (14 cm) display with optional touchscreen. The IQAN-MD4 has a rugged mechanical design and is completely sealed. The use of optical bonded display glass improves the readability, avoids light refraction and also eliminates possible condensation.

The display units have a pleasing, aesthetic design that blends with modern cabins. A touchscreen interface is offered for interactive, intuitive HMI (code T1). The IQAN-MD4 also has IP-camera support (code E2). There is no need for separate camera monitors.

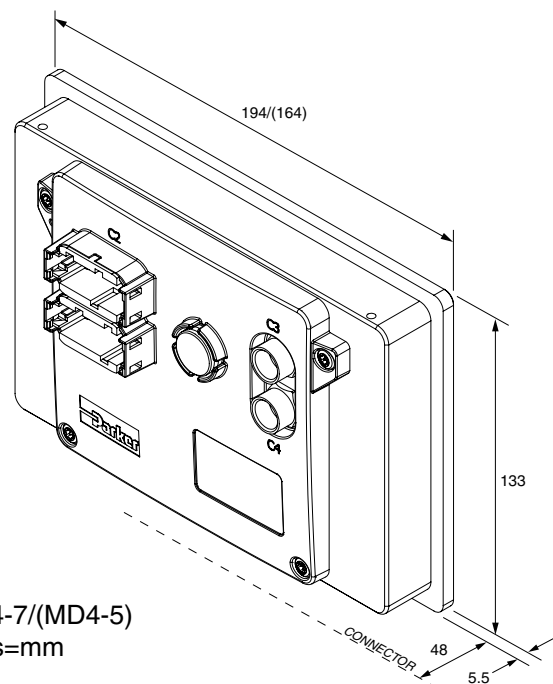
Mounting is easy, with steel clips for a well integrated, flush mount in cabin panels, or the back of the unit has an optional stand-alone bracket compatible with RAM™ mount components. The MD4 may be mounted in landscape or portrait orientation for easy integration of HMI or mechanics.

Description

IQAN-MD4-7-T1E2
IQAN-MD4-5-T0E1
IQAN-MD4-5-T1E2
IQAN-MD4-10-T1E2

Ordering PN

20077771
20077772
20077773
20077774



MD4-7/(MD4-5)
units=mm



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) Protocols	2 ICP, SAE J1939, CANopen, etc
RS-232 Protocols	1 AT-Hayes,GSM07.07, GSM07.05, IDP
USB 2.0 (full speed) ¹	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) ²
Signal high	4 Vdc
Signal low	1 Vdc

1) The USB driver circuit and LCD were updated on June 1, 2015
 2) 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/display unit that works with a variety of expansion modules in the IQANdesign platform. 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.

The MD3 has a large internal memory for events and logging that is capable of storing 80,000 records. The 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 3 CAN busses. All CAN busses may be configured as ICP (IQAN CAN Protocol), SAE J1939 or Generic CAN. The unit supports CAN connection and USB for communication with a PC.

Description

IQAN-MD3-M15

Phased-out part number

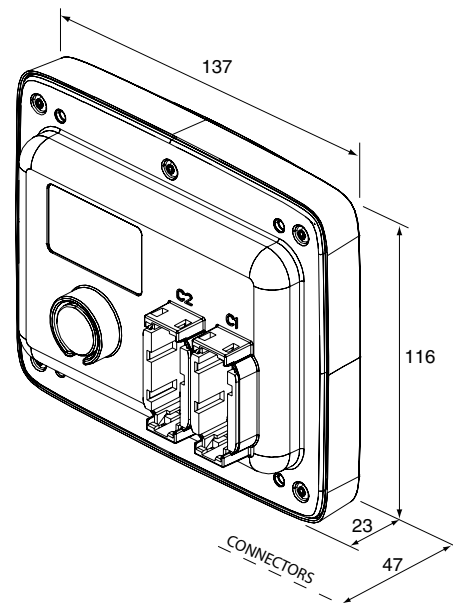
IQAN-MD3

Ordering PN

20077793³

20072409⁴

3) This p/n is used after June 1, 2015 and requires software versions 2.63 and 3.17 or higher.
 4) This p/n was used before June 1, 2015.



units=mm



General

Weight	0.5 kg
Temperature range	-40 to +85 °C
Protection	outdoor, chassis
Voltage supply	9 - 32 Vdc
Current consumption (idle)	180 mA (24V) 250 mA (12V)

Communication interfaces

CAN buses	2
Protocols	ICP (IQAN CAN Protocol) SAE J1939, Generic CAN

Outputs

Max number of outputs	8
Proportional outputs	
Current output pairs	2
Type	current closed loop
Signal range	100 - 2500 mA
Dither frequency	70 - 1000 Hz
Resolution	1 mA
PWM outputs (HS)	4
Type	high side switch
Max load	2 A (single)
PWM outputs (LS)	4
Type	low side switch
Max load	2.5 A (single)

Inputs

Max number of inputs	18
Voltage inputs	10
Signal range	8 x 0 - 5 Vdc 2 x 0 - 32 Vdc
Resolution	12 bit
Current-loop inputs	2
Signal range	0 - 20 mA, 13 bit
Timer inputs:	
Frequency, PWM, Pulse	6
Signal high	4 Vdc - 32 Vdc
Signal low	0 - 1 Vdc
Range	0 - 50,000 Hz
Digital inputs	0 (up to 6)
Signal high	4 Vdc - 32 Vdc
Signal low	0 - 1 Vdc

Connector

Type	1 x Molex MX123, 66 pos.
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Application

The IQAN-MC41 controller is the lowest I/O count module in the MC4 family. It is best for smaller applications such as task-oriented control, implementing single features on a vehicle (e.g. valve driver for auxiliary hydraulic function).

The IQAN-MC41 is designed to be either an IEC 61508 SIL2 Functional Safety (-FS) variant, or a performance optimized, standard controller.

The 3 core CPU architecture of the IQAN-MC41 provides computational power that allows it to perform high speed (ex. 1 ms) control loops for time critical functions. Lockstep CPU and hardware redundancy offers very high real-time performance in safety critical applications.

There are Voltage inputs in 2 different scales, Current loop inputs for 4-20 mA, Timer inputs (used for frequency, PWM and pulse devices) and Digital (on-off) inputs. Voltage and Timer inputs share pin positions with Digital inputs.

The IQAN-MC41 has 2 double proportional outputs for controlling valves. These outputs can control up to 2 bi-directional proportional valve sections or 2 single solenoid devices (ex. proportional cartridge valves).

The unit also has 4 high-side PWM outputs and 4 low-side PWM outputs.

The IQAN-MC41 footprint is small enough for any installation. The enclosure is rated IP66 + IP69K and is a rugged mechanical design, sealed for outdoor use.

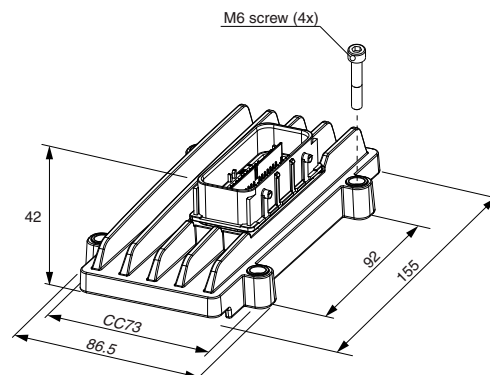
To meet the environment found in mobile machines the MC41 uses a 66 position Molex MX123 high reliability connector, made for harsh environment and high vibration applications.

Description

IQAN-MC41	
IQAN-MC41-FS	

Ordering PN

20085111
20085121



units=mm



General

Weight	0.8 kg
Temperature range	-40 to +85 °C
Protection	outdoor, chassis
Voltage supply	9 - 32 Vdc
Current consumption (idle)	190 mA (24V) 320 mA (12V)

Communication interfaces

CAN buses	3
Protocols	ICP (IQAN CAN Protocol) SAE J1939, Generic CAN
Ethernet	10 base T

Outputs

Max number of outputs	16
Proportional outputs	
Current output pairs	6
Type	current closed loop
Signal range	100 - 2500 mA
Dither frequency	70 - 1000 Hz
Resolution	1 mA
PWM outputs (HS)	4
Type	high side switch
Max load	2 A (single)
PWM outputs (LS)	12
Type	low side switch
Max load	2.5 A (single)

Inputs

Max number of inputs	18
Voltage inputs	10
Signal range	8 x 0 - 5 Vdc 2 x 0 - 32 Vdc
Resolution	12 bit
Current-loop inputs	2
Signal range	0 - 20 mA, 13 bit
Timer inputs:	
Frequency, PWM, Pulse	6
Signal high	4 Vdc - 32 Vdc
Signal low	0 - 1 Vdc
Range	0 - 50,000 Hz
Digital inputs	0 (up to 6)
Signal high	4 Vdc - 32 Vdc
Signal low	0 - 1 Vdc

Connector

Type	1 x Molex MX123, 66 pos.
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Application

The IQAN-MC42 controller is an intermediate I/O count module in the MC4 family. It is best for mid-size applications such as powertrain control (e.g. power shift transmissions) or distributing I/O on a vehicle (physically placed close to functions).

The IQAN-MC42 is designed to be either an IEC 61508 SIL2 Functional Safety (-FS) variant, or a performance optimized, standard controller.

The 3 core CPU architecture of the IQAN-MC42 provides computational power that allows it to perform high speed (ex. 1 ms) control loops for time critical functions. Lockstep CPU and hardware redundancy offers very high real-time performance in safety critical applications.

There are Voltage inputs in 2 different scales, Current loop inputs for 4-20 mA, Timer inputs (used for frequency, PWM and pulse devices) and Digital (on-off) inputs. Voltage and Timer inputs share pin positions with Digital inputs.

The IQAN-MC42 has 6 double proportional outputs for controlling valves. These outputs can control up to 6 bi-directional proportional valve sections or 6 single solenoid devices (ex. proportional cartridge valves).

The unit also has 4 high-side PWM outputs and 12 low-side PWM outputs.

The IQAN-MC42 footprint is small enough for any installation. The enclosure is rated IP66 + IP69K and is a rugged mechanical design, sealed for outdoor use.

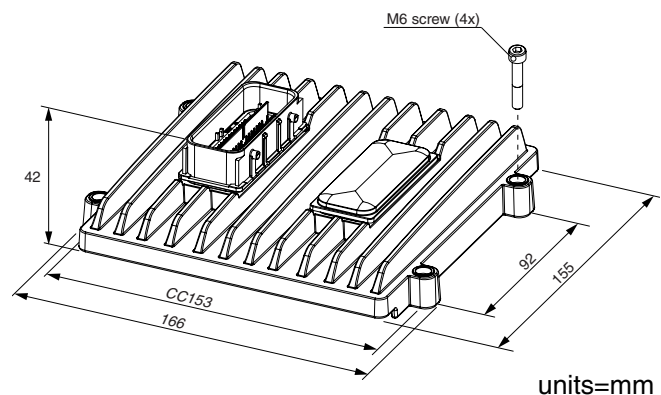
To meet the environment found in mobile machines the MC42 uses a 66 position Molex MX123 high reliability connector, made for harsh environment and high vibration applications.

Description

IQAN-MC42
IQAN-MC42-FS

Ordering PN

20085112
20085122



units=mm



General

Weight	0.8 kg
Temperature range	-40 to +85 °C
Protection	outdoor, chassis
Voltage supply	9 - 32 Vdc
Current consumption (idle)	160 mA (24V) 240 mA (12V)

Communication interfaces

CAN buses	5
Protocols	ICP (IQAN CAN Protocol) SAE J1939, Generic CAN
Ethernet	10 base T

Outputs

Max number of outputs	36
Proportional outputs	
Current output pairs	10
Type	current closed loop
Signal range	100 - 2500 mA
Dither frequency	70 - 1000 Hz
Resolution	1 mA
PWM outputs (HS)	8
Type	high side switch
Max load	2 A (single)
PWM outputs (LS)	20
Type	low side switch
Max load	2.5 A (single)
PWM outputs (LS)	8
Type	low side switch
Max load	300 mA

Inputs

Max number of inputs	50
Voltage inputs	28
Signal range	26 x 0 - 5 Vdc 2 x 0 - 32 Vdc
Resolution	12 bit
Current-loop inputs	4
Signal range	0 - 20 mA, 13 bit
Timer inputs:	
Frequency, PWM, Pulse	6
Signal high	4 Vdc - 32 Vdc
Signal low	0 - 1 Vdc
Range	0 - 50,000 Hz
Digital inputs	12 (up to 18)
Signal high	4 Vdc - 32 Vdc
Signal low	0 - 1 Vdc

Connector

Type, C1	1 x Molex MX123, 66 pos.
Type, C2	1 x Molex MX123, 73 pos.

Application

The IQAN-MC43 controller is a large I/O count module in the MC4 family. It is best for bigger applications such as total vehicle control (all hydraulic functions) when it is desired to have the controller centrally located to save valuable space.

The IQAN-MC43 is designed to be either an IEC 61508 SIL2 Functional Safety (-FS) variant, or a performance optimized, standard controller.

The 3 core CPU architecture of the IQAN-MC43 provides computational power that allows it to perform high speed (ex. 1 ms) control loops for time critical functions. Lockstep CPU and hardware redundancy offers very high real-time performance in safety critical applications.

There are Voltage inputs in 2 different scales, Current loop inputs for 4-20 mA, Timer inputs (used for frequency, PWM and pulse devices) and Digital (on-off) inputs. Voltage and Timer inputs share pin positions with Digital inputs.

The IQAN-MC43 has 10 double proportional outputs for controlling valves. These outputs can control up to 10 bi-directional proportional valve sections or 10 single solenoid devices (ex. proportional cartridge valves).

The unit also has 8 high-side PWM outputs and 20 low-side PWM outputs.

The IQAN-MC43 footprint is small enough for any installation. The enclosure is rated IP66 + IP69K and is a rugged mechanical design, sealed for outdoor use.

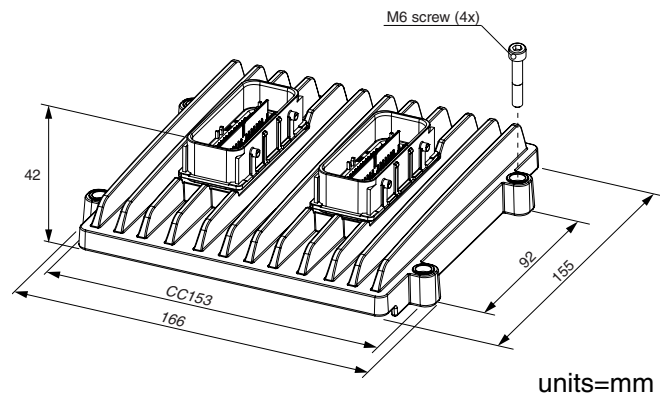
To meet the environment found in mobile machines the MC43 uses 66 position and 73 position Molex MX123 high reliability connectors, made for harsh environment and high vibration applications.

Description

IQAN-MC43
IQAN-MC43-FS

Ordering PN

20085113
20085123



units=mm

IQAN-MC3

IQAN System Products



General

Weight	1.1 kg
Temperature range	
Operating, ambient	-40 to +85 °C
Storage, ambient	-40 to +100 °C
Protection	outdoor, chassis
Voltage supply	9 - 32 Vdc
Current consumption (idle)	160 mA (24V) 240 mA (12V)
CAN buses	4 ¹
Protocols	Parker ICP (IQAN CAN Protocol) SAE J1939, Generic CAN

1) It is recommended that one CAN bus is dedicated for diagnostic purposes (PC interface)

Safety

IEC 61508	Up to SIL2
EN ISO 13849-1	Up to PLd
PFHd	< 10 ⁻⁷

Outputs

Proportional outputs	
Current output pairs	4
Type	current closed loop
Signal range	100-2000 mA
Dither frequency	70-333 Hz
Digital outputs	
Dedicated digital outputs	5
Type	hs+ls switch
Max load	3 x 3 A 2 x 1.5 A

Inputs

Max number of inputs	32
Voltage inputs	16
Signal range	0 - 5 Vdc
Frequency inputs	8
Signal high	4 Vdc - 32 Vdc
Signal low	0 - 1 Vdc
Alternative configuration	Quadrature in (4) Digital in (8)
Dedicated digital inputs	8
Signal high	4 Vdc - 32 Vdc
Signal low	0 - 1 Vdc
Connector	
Type	4 x DT04-18P(key A-D)

Application

The IQAN-MC3 is a SIL2 rated master module in the IQANdesign platform. It can be used as a standalone controller, as a single bus master, or together with other IQAN master modules.

All IQAN modules are designed with the functional safety requirements of mobile machines in mind. The IQAN-MC3 is especially suited for applications with higher demands on functional safety, where there is a need to prove the safety integrity of each implemented safety function. It is designed in accordance with IEC 61508, and can be used to implement safety functions of up to SIL2. When applying EN ISO 13849-1 for safety functions, it can be used as a PLd subsystem.

All of the 32 inputs on the IQAN-MC3 can be used for safety related signals, when the inputs are configured in pairs. On the unit there are analog inputs for 0-5 V signals from e.g. hall-effect or potentiometer sensors; digital inputs for e.g. switches; and frequency inputs. Frequency inputs can be configured to read signals from quadrature encoders, or alternatively to be used as digital inputs.

As a supply for sensors, it has two separately monitored 5 V reference signals.

All of the outputs on the IQAN-MC3 can be used for safety related signals. There are four proportional current outputs designed to drive proportional hydraulic valves, where each output controls one bi-directional valve section. The unit also has five digital outputs for driving on-off solenoids. Two of these are also intended to function as alarm outputs, for e.g. LED lamps.

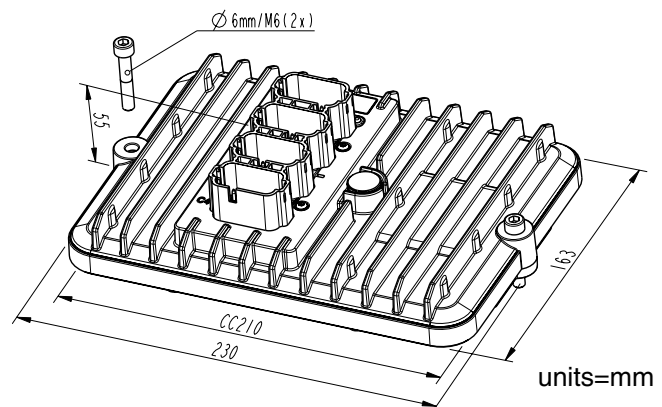
The enclosure is designed to protect the electronics in a harsh environment on mobile machines. On the front of the unit, there are four sealed and individually keyed Deutsch DT connectors.

Description

IQAN-MC3

Ordering PN

20077717



IQAN-MC31

IQAN System Products



General

Weight	1.1 kg
Temperature range	
Operating, ambient	-40 to +85 °C
Storage, ambient	-40 to +100 °C
Protection	outdoor, chassis
Voltage supply	9 - 32 Vdc
Current consumption (idle)	160 mA (24V) 240 mA (12V)
CE marking	2004/108/EC

Communication interfaces

CAN buses	4
Protocols	Parker ICP (IQAN CAN Protocol) SAE J1939, Generic CAN

Outputs

Proportional outputs	
Current output pairs	4
Type	current closed loop
Signal range	100-2000 mA
Dither frequency	70-333 Hz
Resolution	1 mA
Digital outputs	5
Type	high side switch
Max load	3 x 3 A 2 x 1.5 A
Digital outputs (LS)	5
Type	low side switch
Max load	3 x 3 A 2 x 1.5 A

Inputs

Max number of inputs	32
Voltage inputs	
Number	16
Signal range	0 - 5 Vdc
Resolution	1.2 mV
Frequency inputs	
Number	8 (0)
Signal high	4 Vdc - 32 Vdc
Signal low	0 - 1 Vdc
Alternative configurations	Quadrature in (4) Digital in (8)
Digital inputs	
Number	8
Signal high	4 Vdc - 32 Vdc
Signal low	0 - 1 Vdc

Connector

Type	4 x DT04-18P(key A-D)
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Application

The IQAN-MC31 is a master module in the IQAN design platform. It can be used as a standalone controller, as a single bus master, or together with other IQAN master modules.

The unit is based on the IQAN-MC3 SIL2 rated controller and uses the same hardware, but with software optimized for higher speed and lower memory consumption.

The 32 bit architecture of the IQAN-MC31 provides computational capacity that allows it to perform high speed (ex. 3 ms) control loops for time critical functions. The unit is equipped with a Real Time Clock and can perform data logging functions.

The IQAN-MC31 controller has 16 voltage inputs for connection of 0-5 Vdc signals and 8 frequency inputs for speed and position sensors.

The IQAN-MC31 has 4 double proportional outputs for controlling valves. These outputs can control up to 4 bi-directional proportional valve sections or 4 single solenoid devices (ex. proportional cartridge valves).

The unit also has 5 dedicated on-off outputs that are high-side power outputs and 5 dedicated on-off outputs that are low-side outputs.

A bank of low-side, on-off outputs is typically connected to one or more of the high-side, on-off outputs and are used for low current functions.

The enclosure is designed to protect the electronics in a harsh environment on mobile machines. On the front of the unit, there are four sealed and individually keyed Deutsch DT connectors. The MC31 is designed for mounting outdoor on the chassis.

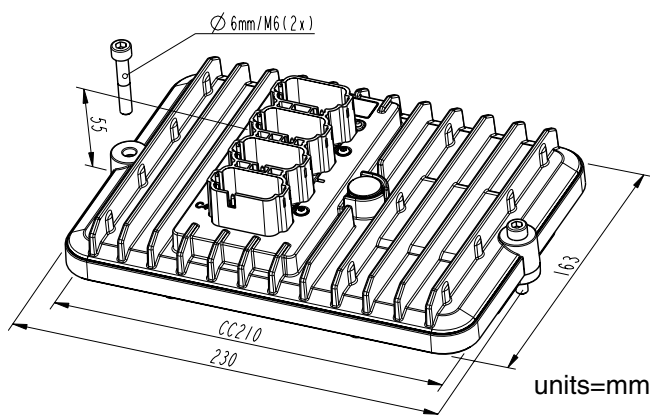
The IQAN-MC31 is a mature product and is not recommended for new installations.

Description

IQAN-MC31

Ordering PN

20077786



IQAN-MC2

IQAN System Products



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 ¹

Outputs

Proportional outputs	8 double (max) ²
Type current mode	current - closed-loop
PWM mode	voltage - open-loop
Signal range	100 - 2000 mA
Dither frequency	25 - 333 Hz
Resolution	0.1 mA
Digital outputs	24 (max) ²
Type	high side switch
Total load (all outputs)	16 A

Inputs

Voltage inputs	13 (max) ²
Signal range	0 - 5 VDC
Resolution	1.2 mV
Frequency inputs	5 (max) ²
Signal range (speed mode)	2 - 20000 Hz
(position mode)	0 - 20000 Hz
Digital inputs	13 (max) ²
Signal high	4 VDC - V _{BAT}
Signal low	0 - 1 VDC

- 1) the USB driver circuit was updated on January 1, 2015.
- 2) The flexible inputs and outputs share the same physical pins. The user defines the channels/pins with IQANdesign.

Application

The IQAN-MC2 is a flexible master unit that works with a variety of expansion modules in the IQANdesign platform control 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.

Description

IQAN-MC2-M14

Phased-out part number

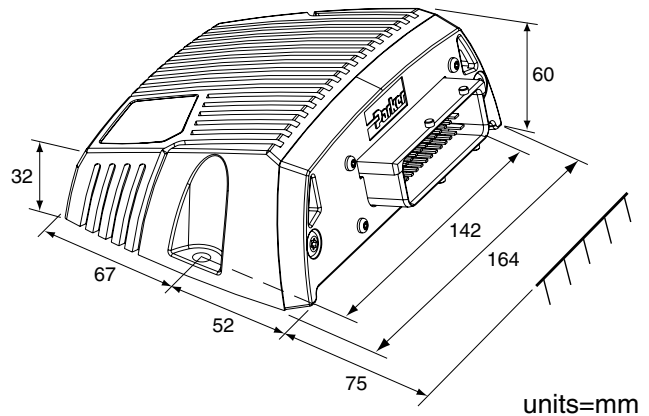
IQAN-MC2

Ordering PN

20077787³

20070899⁴

- 3) This p/n is used after January 1, 2015 and requires software versions 2.61 and 3.14 or higher.
- 4) This p/n was used before January 1, 2015.



IQAN-XC10

IQAN System Products



General

Weight	1.2 kg
Temperature range	
Operating, ambient	-40 to +85 °C
Storage, ambient	-40 to +85 °C
Protection	IP66
Voltage supply	7.5 - 32 Vdc
Current consumption (idle)	60 mA (28 VDC) 70 mA (14 VDC)
Data interface	Parker ICP (IQAN CAN Protocol)

Outputs

Digital out high	16
Type	high-side switch
Max load	2.5 A
Max PWM frequency	500 Hz
Digital out low	4
Type	low-side switch
Max load	2.5 A

Inputs

Voltage inputs	10
Signal range	0 - 5 Vdc
Resolution	5 mV
Frequency inputs	4
Signal range	0 - 10000 Hz
Digital inputs	16
Signal high	3.65 Vdc - VBAT
Signal low	0 - 1.56 Vdc

Application

The IQAN-XC10 is an IQANdesign platform expansion module in the IQAN product group. This unit is designed to get a high digital I/O count in one module.

All IQAN expansion modules communicate with a master over a CAN bus, using the IQAN CAN protocol. The module has a large number of digital inputs for connection to switches. It also has analog inputs for connection to 0-5 Vdc sensors from resistive or Hall-effect sensors and joysticks. The sensors can be powered from the 5 V reference on the module. For flexibility, all of the analog voltage inputs can also be configured as digital inputs.

There are two types of frequency inputs, allowing for both active sensors, such as Hall effect sensors, and for inductive pickup sensors.

The module has a large number of digital outputs designed for driving on-off solenoids in a hydraulic system. The dedicated digital outputs can also be used for driving other types of loads, such as LEDs.

Some of the outputs can also be configured as PWM outputs, for less demanding proportional functions when temperature compensation is not needed. The PWM outputs are configured in pairs, where each pair is intended for one valve section. These outputs are monitored, and use a combination of high-side and low-side switches to make it possible to shut down in the event of wiring faults.

The IQAN-XC10 is designed for use on mobile machinery. It uses two keyed 35-pin Ampseal connectors. The unit also has two LEDs for aiding diagnostics when it is not connected to a master display.

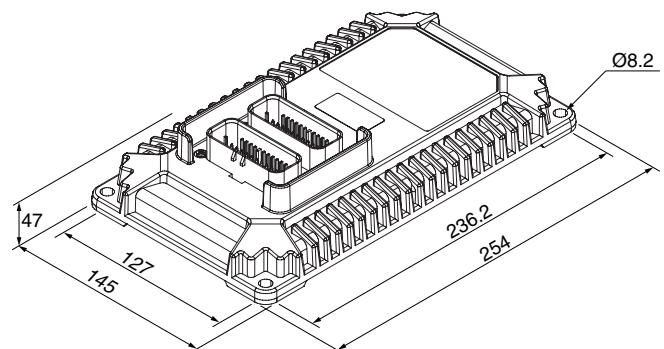
The IQAN-XC10 is a mature product and is not recommended for new installations.

Description

IQAN-XC10

Ordering PN

20077638ECD



units=mm

IQAN-XA2

IQAN System Products



General

Weight	0.7 Kg
Operating temperature	-40 to +70 °C
Protection	outdoor use
Voltage supply	11- 32 VDC
Current consumption (idle)	75 mA (28 VDC) 95 mA (14 VDC)
Data interface	Parker ICP (IQAN CAN Protocol)

Outputs

Proportional outputs	6 double (max) ¹
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	12 (max) ¹
Type	high side switch
Total load (all outputs)	20 A

Inputs

Voltage inputs	8 (max) ¹
Signal range	0 - 5 VDC
Resolution	5 mV
Frequency inputs	4 (max) ¹
Signal range (speed mode)	2 - 30000 Hz
(position mode)	0 - 30000 Hz
Quadrature inputs	2 (max) ¹
Signal range (speed mode)	2 - 30000 Hz
(position mode)	0 - 30000 Hz
Digital inputs	20 (max) ¹
Signal high	4 VDC - V _{BAT}
Signal low	0 - 1 VDC

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

Application

The IQAN-XA2 is an expansion module in the IQAN product group and is used with the IQANdesign platform. 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.

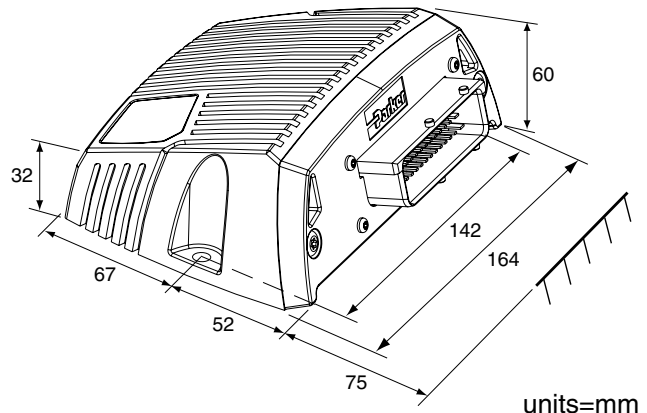
Diagnostics: If an error is detected an LED on the top of the controller flashes a sequence to indicate the nature of the error.

Description

IQAN-XA2

Ordering PN

5010033





General

Weight	0.7 Kg
Operating temperature	-40 to +70 °C
Protection	outdoor use
Voltage supply	11- 32 VDC
Current consumption (idle)	75 mA (28 VDC) 95 mA (14 VDC)
Data interface	Parker ICP (IQAN CAN Protocol)

Outputs

Digital outputs	12
Type	high side switch
Total load (all outputs)	20 A

Inputs

Voltage inputs	8 (max) ¹
Signal range	0 - 5 VDC
Resolution	5 mV
Digital inputs	20 (max) ¹
Signal high	4 VDC - V _{BAT}
Signal low	0 - 1 VDC

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

Application

The IQAN-XS2 is an expansion module in the IQAN product group and is used with the IQANdesign platform. 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.

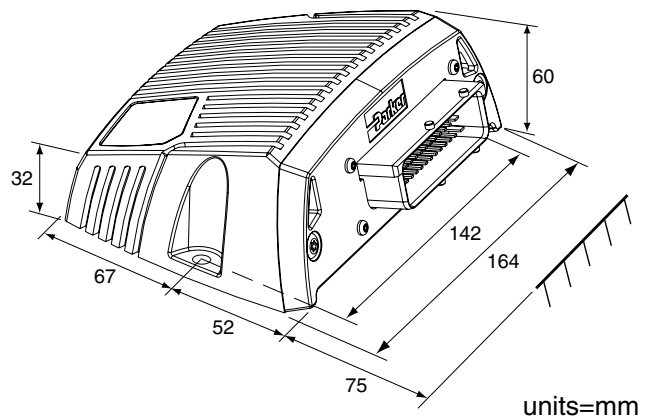
Diagnostics: If an error is detected an LED on the top of the controller flashes a sequence to indicate the nature of the error.

Description

IQAN-XS2

Ordering PN

5010017





General

Weight	0.1 kg
Temperature range	
Operating, ambient	-40 to +70 °C
Storage, ambient	-40 to +100 °C
Protection	IP32
Voltage supply	9 - 32 Vdc
Current consumption (idle)	20 mA (28 Vdc) 30 mA (14 Vdc)
CE marking	2004/108/EC
Data interface	Parker ICP (IQAN CAN Protocol)

Outputs

Digital out low	up to 8 ¹
Type	low-side switch
Max load, 1 output	300 mA
Max load, all outputs	1700 mA

Inputs

Voltage inputs	up to 8 ¹
Signal range	0 - 5 Vdc
Resolution	1.22 mV
Frequency inputs	up to 10 ¹
Signal range (FIN-A to B)	1 - 20000 Hz
Signal range (FIN-C to J)	1 - 4000 Hz
Logic level high	>4 Vdc
Logic level low	<1 Vdc
Encoder inputs	up to 1 ¹
Signal range	0 - 20000 Hz
Logic level high	>4 Vdc
Logic level low	<1 Vdc
Digital inputs	up to 20 ¹
Signal high	>4 Vdc
Signal low	<1 Vdc

Sensor supplies

Voltage references	2
Supply range	5 Vdc ±100 mV
Max load C2 connector	70 mA (has 2 pins)
Max load C3 connector	70 mA (has 1 pin)

1) depending on configuration

Application

The IQAN-XC21 is an IQANdesign platform expansion module in the IQAN product group. This unit is a small dimension I/O module to be used as an expansion unit in an IQAN system. It is also useful as an interface with the IQAN-LC6-X05 joystick to provide CAN capability.

All IQAN expansion modules communicate with a master over a CAN bus, using the IQAN CAN protocol. The IQAN-XC21 module has I/O flexibility that allows the user freedom in defining signals for measurement and control.

The IQAN-XC21 has up to 20 digital inputs for connection to switches. Up to 8 of these inputs may be configured as voltage inputs for connection of 0-5 Vdc signals from resistive or Hall-effect sensors and joysticks. The sensors can be powered from one of the 5 Vdc reference voltages on the module.

The remaining 12 inputs can be configured as up to 10 frequency inputs and 1 encoder input for measuring speed and position.

The module's low power digital outputs are designed for driving low power loads such as relays, LEDs or alarm buzzers. The outputs share pins with the inputs and are configured using IQAN software.

The IQAN-XC21 is designed for in-cab use on mobile machinery. It uses four Molex Micro-fit connectors of varying pin density to prevent wiring mix-ups. The module has addressing in the wiring harness through use of an IDtag; the addressing of the IQAN-XC21 allows up to 8 modules of this type on the bus.

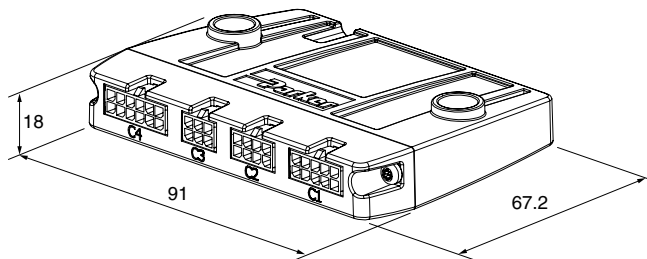
The housing is designed for stacking multiple modules, providing a high density of I/O in a small footprint. The module also has pins that allow 'daisy chaining' of power and CAN for simplified cable harness installation.

Description

IQAN-XC21

Ordering PN

20077775



units=mm



General

Weight	0.2 kg
Temperature range	
Operating, ambient	-40 to +70 °C
Storage, ambient	-40 to +100 °C
Protection	IP65, IP6K9K
Voltage supply	9 - 32 Vdc
Current consumption (idle)	20 mA (28 Vdc) 30 mA (14 Vdc)
CE marking	2004/108/EC
Data interface	Parker ICP (IQAN CAN Protocol)

Outputs

Digital out low	up to 8 ¹
Type	low-side switch
Max load, 1 output	300 mA
Max load, all outputs	1700 mA

Inputs

Voltage inputs	up to 8 ^{1,2}
Signal range	0 - 5 Vdc
Resolution	1.22 mV
Frequency inputs	up to 10 ¹
Signal range (FIN-A to B)	1 - 20000 Hz
Signal range (FIN-C to J)	1 - 4000 Hz
Logic level high	>4 Vdc
Logic level low	<1 Vdc
Encoder inputs	up to 1 ¹
Signal range	0 - 20000 Hz
Logic level high	>4 Vdc
Logic level low	<1 Vdc
Digital inputs	up to 12 ¹ (20 ^{1,2})
Signal high	>4 Vdc
Signal low	<1 Vdc

1) depending on configuration
 2) -XC23 only

Application

The IQAN-XC22 and IQAN-XC23 are IQANdesign platform expansion modules in the IQAN system. This type of unit is a small dimension I/O module to be used as an expansion unit in an IQAN control system.

All IQAN expansion modules communicate with a master over a CAN bus, using the IQAN CAN protocol. The IQAN-XC22/23 modules have I/O flexibility that allows the user freedom in defining signals for measurement and control.

The IQAN-XC22 has up to 12 digital inputs for connection to switches. These inputs can be configured as up to 10 frequency inputs and 1 encoder input for measuring speed and position.

The IQAN-XC23 has up to 20 digital inputs for connection to switches. Up to 8 of these inputs may be configured as voltage inputs for connection of 0-5 Vdc signals from resistive or Hall-effect sensors and joysticks. The remaining 12 inputs can be configured as up to 10 frequency inputs and 1 encoder input for measuring speed and position.

The module's low power digital outputs are designed for driving low power loads such as relays, LEDs or alarm buzzers. The outputs share pins with the inputs and are configured using IQAN software.

The IQAN-XC22/23 is designed for outdoor use on mobile machinery. It uses 2 or 3 keyed Deutsch DTM connectors, depending on model, to prevent wiring mix-ups. The module has addressing in the wiring harness through use of an IDtag; the addressing of the IQAN-XC22/23 allows up to 8 modules of this type on the bus.

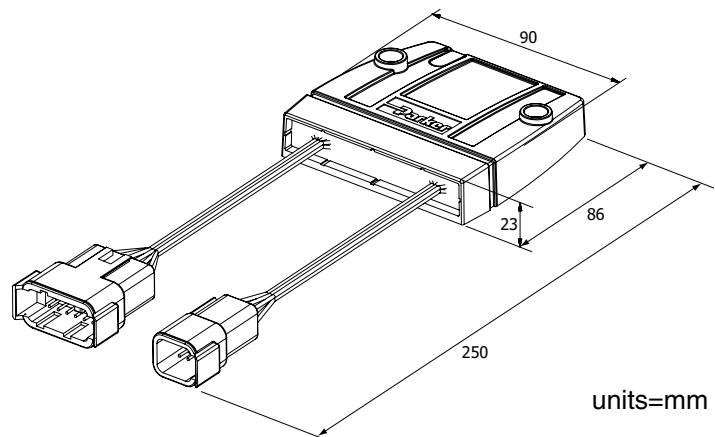
The housing is designed for stacking multiple modules, providing a high density of I/O in a small footprint.

Description

IQAN-XC22
IQAN-XC23

Ordering PN

20077784
20077792



units=mm



General (Lever base)

Weight	.41 kg
Voltage supply	9 - 32 Vdc
Current consumption	45mA @ 14Vdc 30mA @ 28Vdc
CAN (ISO 11898) Protocol	CAN 2.0b ICP (IQAN Protocol)

Mechanical (Lever base)

Angle of movement	±18°
Expected life (full stroke cycles)	5 million
Lever force in neutral, XY	0.6 Nm
Full actuated, XY direction	1.4 Nm
One time loading (max.)	100 Nm

Environmental (Lever base)

Temperature range	
Operating, ambient	-40 to +85° C
Storage, ambient	-40 to +100° C
Sealing (above flange)	IP65

Connection

Electrical connection	Deutsch DTM, 2x 6 pos., 1x 12 pos.
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Inputs

Voltage inputs ¹	8(1)
Signal range	0-5 Vdc
Resolution	1.2 mV
Digital inputs	5
Signal high	>4 Vdc
Signal low	<= 1 Vdc

1) The voltage inputs share the same physical pins. The user defines the channels/pins with IQAN software.

Outputs

Digital output Type	1 high side switch Max load 200 mA
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Application

The IQAN-LC5-C01 is a large, coordinate joystick that incorporates ruggedness, functionality, light weight with high flexibility for mobile market applications. The unit is extremely robust, able to withstand aggressive conditions during outdoor use and in outdoor installations, including EMI, vibrations and a wide temperature range. The IQAN-LC5-C01 has high I/O count and the ability to support up to 5 axes in IQANdesign platform applications.

Fourth generation IQAN-LL joysticks are easily replaced with the IQAN-LC5-C02/C03 versions. The U, N and G handles are offered.

The IQAN-LC5 housing has integrated Deutsch transportation connectors. The handle cable may be routed completely through the main, non-corrosive housing. This makes field mounting of new handles or replacing a bellow very easy to accomplish.

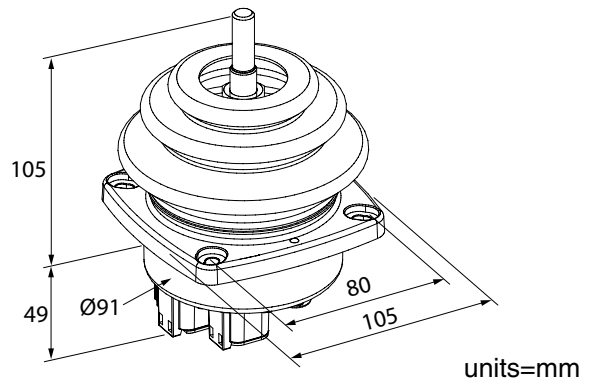
All proportional inputs are of contactless Hall effect type with dual sensors to provide redundancy for high safety and reliability. This makes it easy for the application designer to meet high safety requirements on functions by using IQAN software.

The IQAN-LC5-C01/C02 CAN levers are connected to other modules through a CAN bus.

Description

Description	Ordering PN
IQAN-LC5-C01-U1	20076330
IQAN-LC5-C01-U2	20076331
IQAN-LC5-C01-G	20077750
IQAN-LC5-C02-U1	20076333
IQAN-LC5-C02-U2	20076334
IQAN-LC5-C02-N2	20077690
IQAN-LC5-C02-N2E ¹	20077686
IQAN-LC5-C02-N2T	20077685
IQAN-LC5-C02-N4	20077688
IQAN-LC5-C03-G	20077752

1) wired to replace LL-E2 handle functionality





General (handle)

Weight .25 kg
 Temperature range -40 to +85° C
 Sealing outdoor use

Buttons/Trigger

Expected life (electrical) 0.5 million
 Expected life (mechanical) 1 million
 Travel 1.5 mm
 Actuating force 2 - 5 Nm
 Switching current (max) 400 mA, 32 VAC, resistive load

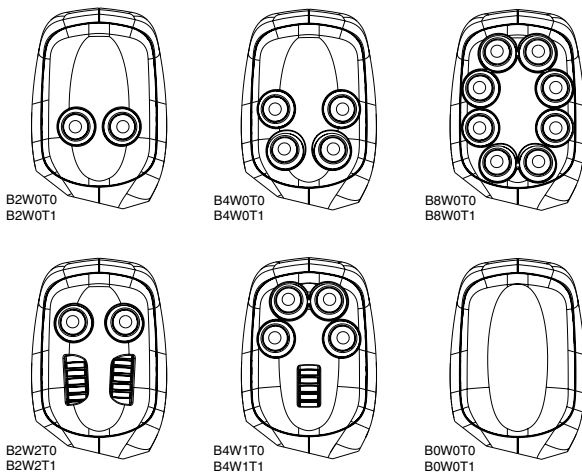
Thumb wheel

Rated power supply (Vs) 5 Vdc
 Load resistive (min) 4.5 kΩ
 Load capacitive (max) 1 uF
 Current consumption (typ) 16 mA
 Analog output active range 10%-90% Vs
 Resolution < 2 mV
 Angle of movement ± 25 degrees
 Expected life (operations) 5 million

Connection

B0W0T1 / B2W0T0 / B2W0T1 / B4W0T0 B4W0T1 / B4W1Tx / B2W2Tx / B8W0T1 Deutsch DTM, 6 pos.
 Deutsch DTM, 12 pos.

MP standard faceplate configurations



Application

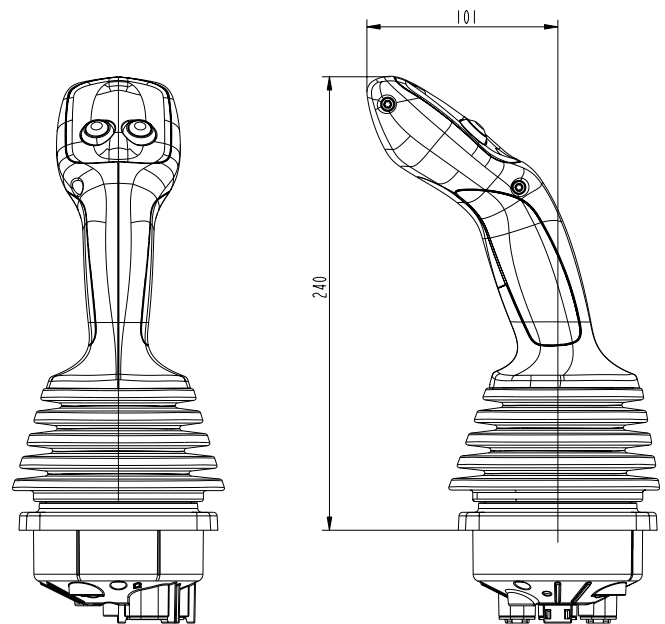
The MP handle option provides a variety of control interfaces in an ergonomic, multi-function handle that comfortably fits your hand. The handle is a robust design, able to withstand heavy use in outdoor installations, including exposure to a wide range of automotive chemicals. The handle has the capability to have a maximum of 8 buttons or 2 proportional thumb wheels in the faceplate. Combinations of buttons, thumb wheels, and trigger are also possible. The MP handle will be assembled to the IQAN-LC5 base, and the cables are routed through the base. The push buttons and thumb wheel are easily connected to the joystick base by a Deutsch DTM connector.

The MP handle is made to fit either the right or left hand, reducing inventory part numbers. The buttons are large, and have a nice tactile feel. The proportional thumb wheel has dual sensors providing 2 crossed outputs that may be compared in IQAN modules for safe operation.

Description

Description	Ordering PN
IQAN-LC5-C01-MPB2W0T0	20076996
IQAN-LC5-C01-MPB2W0T1	20076997
IQAN-LC5-C01-MPB2W2T1	20076999
IQAN-LC5-C01-MPB4W0T0	20077000
IQAN-LC5-C01-MPB4W0T1	20077001
IQAN-LC5-C01-MPB4W1T1	20077003
IQAN-LC5-C01-MPB8W0T1	20077005

Consult datasheet and pricelist for other IQAN-LC5-C01-MP options and ordering part numbers.



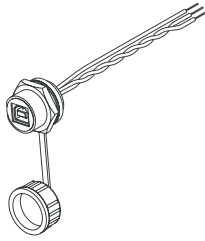
units=mm

Accessories

Communication cables

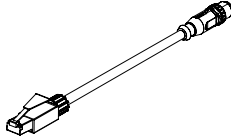
5030124

USB adapter-cable, panel mount
length: 0,4 meters
use with: IQAN-MC2, -MD3



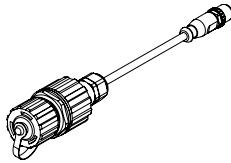
20077780

Ethernet cable
length: 1,5 meters
use with: IQAN-MD4



20077785

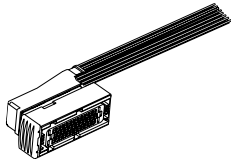
Ethernet cable, panel mount
length: 1,5 meters
use with: IQAN-MD4



Prototype installation cables

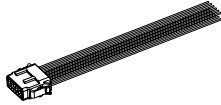
5030030

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



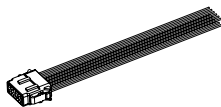
5030125

C1-cable, sealed
length: 2,5 meters
use with: IQAN-MD3, -MD4



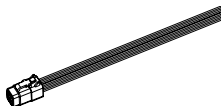
5030126

C2-cable, sealed
length: 2,5 meters
use with: IQAN-MD3, -MD4



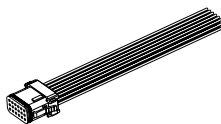
5030127¹

C1-cable, sealed
length: 2,5 meters
use with: IQAN-LC5-C01, -C02
1) from catalog MSG33-1800/US



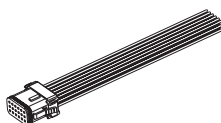
5030216

C1-cable, sealed, key A
length: 2,5 meters
use with: IQAN-MC3, -MC31



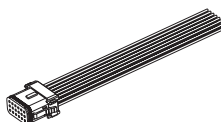
5030217

C2-cable, sealed, key B
length: 2,5 meters
use with: IQAN-MC3, -MC31



5030218

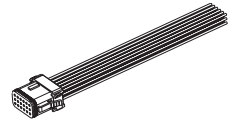
C3-cable, sealed, key C
length: 2,5 meters
use with: IQAN-MC3, -MC31



IQAN System Products

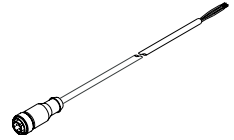
5030219

C4-cable, sealed, key D
length: 2,5 meters
use with: IQAN-MC3, -MC31



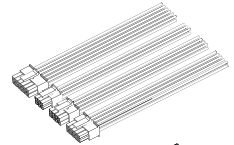
20077744

Power/CAN cable
length: 2,0 meters
use with: IQAN-G3



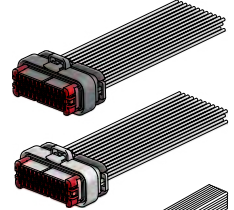
20077777

C1-C4 cables
length: 2,5 meters
use with: IQAN-XC21



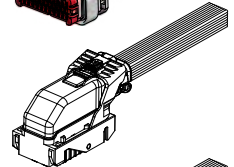
20085102

C1-C2 cables
length: 2,5 meters
use with: IQAN-XC10



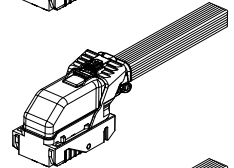
20085116

C1-cable
length: 2,5 meters
use with: IQAN-MC42, -MC43



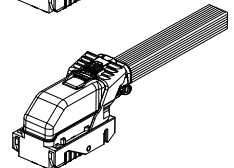
20085117

C-2 cable
length: 2,5 meters
use with: IQAN-MC43



20085124

C-1 cable
length: 2,5 meters
use with: IQAN-MC41



Connector kits

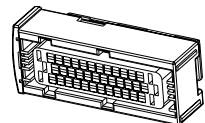
5031022

C1-connector, 6 position
use with: IQAN-MDM, -LF1



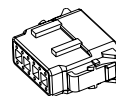
5031063

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



20072406

C1-connector (grey), 12 position
use with: IQAN-G1, -XC22



20072408¹

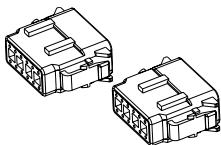
C1-connector (grey), 6 position
use with: IQAN-XC22, -XC23
1) from catalog MSG33-1800/US



Accessories

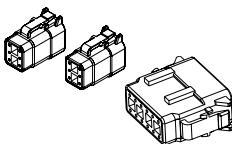
20073081

C1-connector (grey), 12 position
C2-connector (black), 12 position
use with: IQAN-MD3, -MD4, -XC23



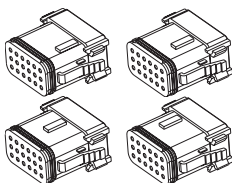
5035007

C1/C3-connector (grey), 6 pos.
C2-connector (grey), 12 position
use with: IQAN-LC5-C01, -C02/3



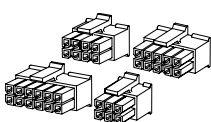
5035016

C1-connector (key A), 18 position
C2-connector (key B), 18 position
C3-connector (key C), 18 position
C4-connector (key D), 18 position
use with: IQAN-MC3, -MC31



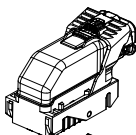
20077776

C1-connector, 12 position
C2-connector, 6 position
C3-connector, 8 position
C4-connector, 10 position
use with: IQAN-XC21



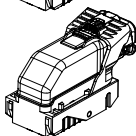
20085114

C1-connector, 66 position
use with: IQAN-MC4x



20085115

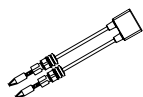
C2-connector, 73 position
use with: IQAN-MC43



Address tags

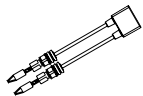
5030060 - 5030067

IQAN address tags 0-7 with AMP terminals.
Bag of 10 pcs.



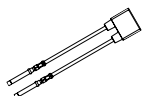
5030070 - 5030077

IQAN address/termination tags 0T-7T with AMP terminals.
Bag of 10 pcs.



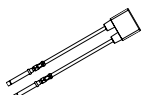
5030160 - 5030167

IQAN address tags 0-7 with Deutsch DTM terminals.
Bag of 10 pcs.



5030170 - 5030177

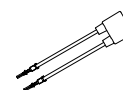
IQAN address/termination tags 0T-7T with Deutsch DTM terminals.
Bag of 10 pcs.



IQAN System Products

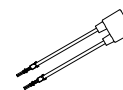
20085020 - 20085027

IQAN address tags 0-7 with Molex MicroFit terminals.
Bag of 10 pcs.



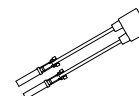
20085030 - 20085037

IQAN address/termination tags 0T-7T with Molex MicroFit terminals.
Bag of 10 pcs.



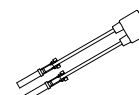
20085050 - 20085057

IQAN address tags 0-7 with Deutsch DT terminals.
Bag of 10 pcs.



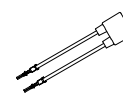
20085060 - 20085067

IQAN address/termination tags 0T-7T with Deutsch DT terminals.
Bag of 10 pcs.



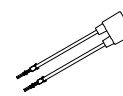
20085130 - 20085137

IQAN address tags 0-7 with Molex MX64 terminals.
Bag of 10 pcs.



20085140 - 20085147

IQAN address/termination tags 0T-7T with Molex MX64 terminals.
Bag of 10 pcs.



Additional items

20085100

IQAN-G11 Bluetooth® gateway for remote diagnostics
use with: IQAN-MD3, -MD4, -MC4x, -MC2.



20085106

IQAN-SV hardened IP camera.
use with: IQAN-MD4 displays.



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

Terms of Sale with Warranty Limitations

Offer of Sale

1. Definitions. As used herein, the following terms have the meanings indicated.

- Buyer:** means any customer receiving a Quote for Products from Seller.
- Goods:** means any tangible part, system or component to be supplied by the Seller.
- Products:** means the Goods, Services and/or Software as described in a Quote provided by the Seller.
- Quote:** means the offer or proposal made by Seller to Buyer for the supply of Products.
- Seller:** means Parker-Hannifin Corporation, including all divisions and businesses thereof.
- Services:** means any services to be supplied by the Seller.
- Software:** means any software related to the Products, whether embedded or separately downloaded.
- Terms:** means the terms and conditions of this Offer of Sale or any newer version of the same as published by Seller electronically at www.parker.com/saleterms.

2. Terms. All sales of Products by Seller are contingent upon, and will be governed by, these Terms and, these Terms are incorporated into any Quote provided by Seller to any Buyer. Buyer's order for any Products whether communicated to Seller verbally, in writing, by electronic data interface or other electronic commerce, shall constitute acceptance of these Terms. Seller objects to any contrary or additional terms or conditions of Buyer. Reference in Seller's order acknowledgement to Buyer's purchase order or purchase order number shall in no way constitute an acceptance of any of Buyer's terms of purchase. No modification to these Terms will be binding on Seller unless agreed to in writing and signed by an authorized representative of Seller.

3. Price; Payment. The Products set forth in Seller's Quote are offered for sale at the prices indicated in Seller's Quote. Unless otherwise specifically stated in Seller's Quote, prices are valid for thirty (30) days and do not include any sales, use, or other taxes or duties. Seller reserves the right to modify prices at any time to adjust for any raw material price fluctuations. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). All sales are contingent upon credit approval and payment for all purchases is due thirty (30) days from the date of invoice (or such date as may be specified in the Quote). Unpaid invoices beyond the specified payment date incur interest at the rate of 1.5% per month or the maximum allowable rate under applicable law.

4. Shipment; Delivery; Title and Risk of Loss. All delivery dates are approximate. Seller is not responsible for damages resulting from any delay. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the shipment carrier at Seller's facility. Unless otherwise agreed, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective indicated shipping date will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

5. Warranty. The warranty related to the Products is as follows: (i) Goods are warranted against defects in material or workmanship for a period of twelve (12) months from the date of delivery or 2,000 hours of use, whichever occurs first; (ii) Services shall be performed in accordance with generally accepted practices and using the degree of care and skill that is ordinarily exercised and customary in the field to which the Services pertain and are warranted for a period of six (6) months from the completion of the Services by Seller; and (iii) Software is only warranted to perform in accordance with applicable specifications provided by Seller to Buyer for ninety (90) days from the date of delivery or, when downloaded by a Buyer or end-user, from the date of the initial download. All prices are based upon the exclusive limited warranty stated above, and upon the following disclaimer:

DISCLAIMER OF WARRANTY: THIS WARRANTY IS THE SOLE AND

ENTIRE WARRANTY PERTAINING TO PRODUCTS. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. SELLER DOES NOT WARRANT THAT THE SOFTWARE IS ERROR-FREE OR FAULT-TOLERANT, OR THAT BUYER'S USE THEREOF WILL BE SECURE OR UNINTERRUPTED. BUYER AGREES AND ACKNOWLEDGES THAT UNLESS OTHERWISE AUTHORIZED IN WRITING BY SELLER THE SOFTWARE SHALL NOT BE USED IN CONNECTION WITH HAZARDOUS OR HIGH RISK ACTIVITIES OR ENVIRONMENTS. EXCEPT AS EXPRESSLY STATED HEREIN, ALL PRODUCTS ARE PROVIDED "AS IS".

6. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to the Seller within ten (10) days of delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the non-conformance is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

7. LIMITATION OF LIABILITY. IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE THE NON-CONFORMING PRODUCT, RE-PERFORM THE SERVICES, OR REFUND THE PURCHASE PRICE PAID WITHIN A REASONABLE PERIOD OF TIME. **IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, NON-COMPLETION OF SERVICES, USE, LOSS OF USE OF, OR INABILITY TO USE THE PRODUCTS OR ANY PART THEREOF, LOSS OF DATA, IDENTITY, PRIVACY, OR CONFIDENTIALITY, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, WHETHER BASED IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE PAID FOR THE PRODUCTS.**

8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which are or become Buyer's property, will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the Products 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. Special Tooling. Special Tooling includes but is not limited to tooling, jigs, fixtures and associated manufacturing equipment acquired or necessary to manufacture Products. A tooling charge may be imposed for any Special Tooling. 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 Special Tooling belonging to Seller that is utilized in the manufacture of the Products, even if such Special Tooling has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any Special Tooling or other property in its sole discretion at any time.

10. Security Interest. To secure payment of all sums due, Seller retains a security interest in all Products delivered to Buyer and, Buyer's acceptance of these Terms is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. User Responsibility. The Buyer through its own analysis and testing, is solely responsible for making the final selection of the Products and assuring that all performance, endurance, maintenance, safety and warning requirements of the application of the Products are met. The Buyer must analyze all aspects of the application and follow applicable industry standards, specifications, and other technical information provided with

Terms of Sale with Warranty Limitations

the Product. If Seller provides Product options based upon data or specifications provided by the Buyer, the Buyer is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products. In the event the Buyer is not the end-user, Buyer will ensure such end-user complies with this paragraph.

12. Use of Products, Indemnity by Buyer. Buyer shall comply with all instructions, guides and specifications provided by Seller with the Products. Unauthorized Uses. If Buyer uses or resells the Products for any uses prohibited in Seller's instructions, guides or specifications, or Buyer otherwise fails to comply with Seller's instructions, guides and specifications, Buyer acknowledges that any such use, resale, or non-compliance is at Buyer's sole risk. Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense costs), whether for personal injury, property damage, intellectual property infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, application, design, specification or other misuse of Products provided by Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, tooling, equipment, plans, drawings, designs or specifications or other information or things furnished by Buyer; (d) damage to the Products from an external cause, repair or attempted repair by anyone other than Seller, failure to follow instructions, guides and specifications provided by Seller, use with goods not provided by Seller, or opening, modifying, deconstructing or tampering with the Products for any reason; or (e) Buyer's failure to comply with these Terms. Seller shall not indemnify Buyer under any circumstance except as otherwise provided in these Terms.

13. Cancellations and Changes. Buyer may not cancel or modify any order for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller, at any time, may change Product features, specifications, designs and availability.

14. Limitation on Assignment. Buyer may not assign its rights or obligations without the prior written consent of Seller.

15. Force Majeure. Seller does not assume the risk and is not liable for delay or failure to perform any of Seller's obligations by reason of events or circumstances beyond its reasonable control ("Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

16. Waiver and Severability. Failure to enforce any provision of these Terms will not invalidate that provision; nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of these Terms by legislation or other rule of law shall not invalidate any other provision herein and, the remaining provisions will remain in full force and effect.

17. Termination. Seller may terminate any agreement governed by or arising from these Terms for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate, in writing, if Buyer: (a) breaches any provision of these Terms (b) appoints a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or one if filed by a third party (d) makes an assignment for the benefit of creditors; or (e) dissolves its business or liquidates all or a majority of its assets.

18. Ownership of Software. Seller retains ownership of all Software supplied to Buyer hereunder. In no event shall Buyer obtain any greater right in and to the Software than a right in the nature of a license limited to the use thereof and subject to compliance with any other terms provided with the Software.

19. Indemnity for Infringement of Intellectual Property Rights. Seller is not liable for infringement of any patents, trademarks, copyrights,

trade dress, trade secrets or similar rights ("Intellectual Property Rights") except as provided in this Section. 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 a third party claim that one or more of the Products sold hereunder infringes the Intellectual Property Rights of a third party in the country of delivery of the Products by the Seller to the Buyer. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of any such claim, and Seller having sole control over the defense of the claim including all negotiations for settlement or compromise. If one or more Products sold hereunder is subject to such a claim, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Products, replace or modify the Products so as to render them non-infringing, or offer to accept return of the Products and refund the purchase price less a reasonable allowance for depreciation. Seller has no obligation or liability for any claim of infringement: (i) arising from information provided by Buyer; or (ii) directed to any Products provided hereunder for which the designs are specified in whole or part by Buyer; or (iii) resulting from the modification, combination or use in a system of any Products provided hereunder. The foregoing provisions of this Section constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for such claims of infringement of Intellectual Property Rights.

20. Governing Law. These Terms and the sale and delivery of all Products are deemed to have taken place in, and shall be governed and construed in accordance with, the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to the sale and delivery of the Products.

21. Entire Agreement. These Terms, along with the terms set forth in the main body of any Quote, forms the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. In the event of a conflict between any term set forth in the main body of a Quote and these Terms, the terms set forth in the main body of the Quote shall prevail. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter shall have no effect. These Terms may not be modified unless in writing and signed by an authorized representative of Seller.

22. Compliance with Laws. Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards, including those of the United States of America, and the country or countries in which Buyer may operate, including without limitation the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act"), U.S. and E.U. export control and sanctions laws ("Export Laws"), the U.S. Food Drug and Cosmetic Act ("FDCA"), and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), each as currently amended. Buyer agrees to indemnify, defend, and hold harmless Seller from the consequences of any violation of such laws, regulations and standards by Buyer, its employees or agents. Buyer acknowledges that it is familiar with all applicable provisions of the FCPA, the Anti-Kickback Act, Export Laws, the FDCA and the FDA and certifies that Buyer will adhere to the requirements thereof and not take any action that would make Seller violate such requirements. Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly, to any governmental official, foreign political party or official thereof, candidate for foreign political office, or commercial entity or person, for any improper purpose, including the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller. Buyer further represents and agrees that it will not receive, use, service, transfer or ship any Product from Seller in a manner or for a purpose that violates Export Laws or would cause Seller to be in violation of Export Laws.

05/17

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