

# FH/FO-CONV-ECAT-ENET-MM(-SM)

FiberOptic Converter EtherCAT / EtherNET

This device is specifically intended to be used in conjunction with imc CRONOS *flex* systems (CRFX). The EtherCAT based CRFX system bus is used to connect CRFX modules, to create a spatially distributed measurement system. These bus connections, usually accomplished via standard CAT5 network cables can be converted to fiber optic transmission.

The FiberOptic Converter is a single port Fast Ethernet to fiber media converter, compatible with both EtherNET and EtherCAT. It can serve to achieve a range extension of a network connection, beyond the usual limit of 100 m and/or provide superior immunity against EMI and disturbance in electrically harsh environments (such as railway applications).

Two variants are available that support either Single-Mode or Multi-Mode fiber types.

The converter differs from ordinary standard media converters in particular in that it supports a special zero latency mode, which is indispensable for operation with real-time systems and is specially certified for operation with EtherCAT.



### Highlights

- 100 MBit Fast Ethernet Media Converter, 100Base TX -> 100Base FX
- Fully specified for EtherCAT, not only EtherNET
- Rated for EN 50121-3-2 Railway EMC compliance
- Rated for -40°C to 70°C ambient temperature operating conditions
- Standard variant MM: Multi-Mode fiber type, max. 2 km range
- Special variant SM: Single-Mode fiber type, max. 30 km range
- Wide range DC supply input: 10 V to 60 V, compatible with:
  - wide range supply of CRFX devices (10 V to 50 V)
  - AC/DC adaptors typically used with imc CRONOS *flex* (CRFX): 24 V and 48 V
  - 12 V vehicle supply
  - auxiliary buffered output of the UPS Power Handle (50 V)
- Tolerating the imc specific PoE scheme (Power-over EtherCAT) for CRFX modules: tolerant against up to 50V PoE power supply voltage on the RJ45 network terminal.

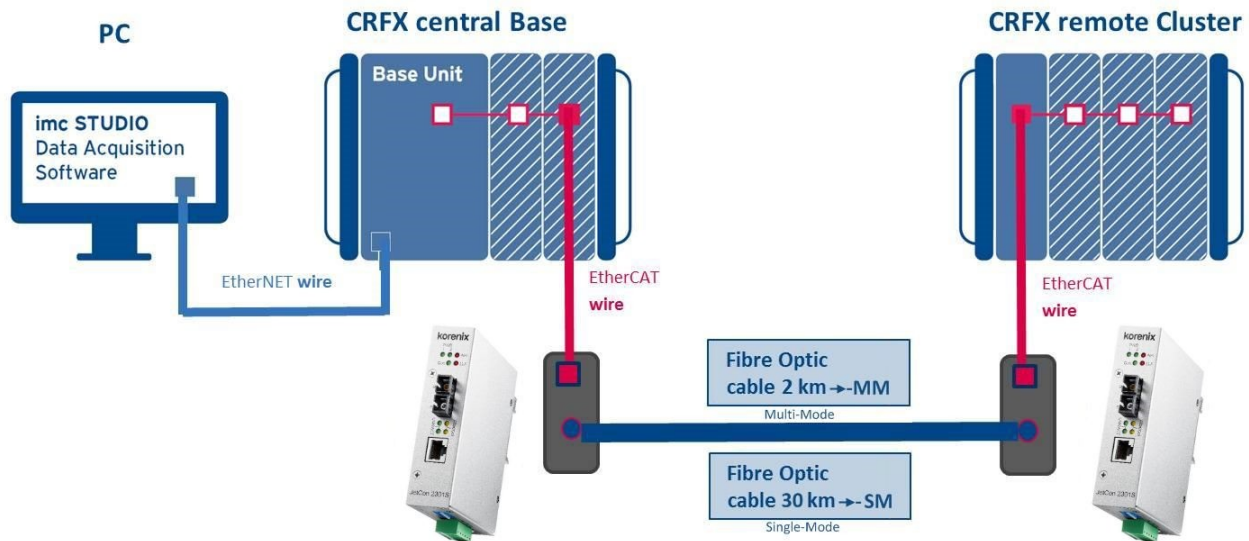
In conjunction with imc measurement systems the two main use cases are fiber optic links for the following network connections, normally based on cabled installations (RJ45, CAT5):

- EtherNET connection between a networked imc device and the PC and/or network switch
- EtherCAT connections that are part of the internal EtherCAT based system bus of CRFX devices. This applies to connections between Base Unit and CRFX modules, or between (groups of) modules.

### Overview of the available variants

Order Code	article no.	properties
FH/FO-CONV-ECAT-ENET-MM	13300017	Multi-Mode (MM) Fiber
FH/FO-CONV-ECAT-ENET-SM	13300038	Single-Mode (SM) Fiber

FiberOptic links in conjunction with imc CRONOS *flex* system bus (EtherCAT)



### Warning

This is not a standard Korenix device, it is modified by imc.

### Power supply

Unlike standard (Korenix) converter devices, this converter is specifically modified, in order to be compatible with the imc specific PoE scheme (Power-over EtherCAT) for CRFX modules. CRFX base units and modules unconditionally feed through their local supply voltage, out of their ECAT OUT terminal (RJ45) in order to supply further modules "downstream".

This fiber optic converter will tolerate such voltages of up to 50 V on its RJ45 terminal. It can however not be supplied via these PoE leads but requires an individual supply on its respective power terminal.

For alternative, independent UPS schemes (without the CRFX POWER-HANDLE), the converter module offers two redundant power supply inputs (decoupled with diodes) to connect a redundant power source (such as a battery).

### Fiber cable types

The standard version of this converter supports Multi-Mode fiber (-MM), suited for transmission of up to 2 km. Even further extension up to 30 km is possible with a special version, suited for Single-Mode fiber (-SM), and available upon request.

Fiber cable (full duplex, dual port) are connected via standard SC connectors, required fiber types (qualities): Patch cable SC-SC Multi-Mode duplex, OM1 ... OM4 -> simple basic qualities OM1 sufficient.

### Operating Modes

While the recommended operating mode for use with EtherCAT systems (imc CRONOS *flex* system bus) is "Pure converter mode", configured as the default setting, the module supports a number of additional operating modes, mainly relevant for EtherNET networking.

To forward link status changes for alerting remote or central management systems, this FiberOptic Converter features remote Link Loss Forwarding technology. It is possible to activate forwarding mode and LLF functions by

adjusting the DIP switch and resetting the converter to apply reconfigurations. Moreover, the module provides an alarm relay to trigger an alarm signal for port or power events.

#### Forwarding mode

The device supports 4 forwarding modes with different behaviors and forwarding latency. The following table indicates the difference of each mode.

Modes	Description
Pure converter	The incoming Ethernet frame is not buffered in the Converter to achieve extreme low data forwarding latency by simply converting signal between copper and fiber ports without packet check.
Store and forward (switching) mode	It will begin to transmit Ethernet frame right after the completion of receiving Ethernet frame. To support up to 148810 packets per second and maintain network efficiency by filtering abnormal packets (switching mode).
Modify cut-through	It will begin to transmit Ethernet frame right after completion of receiving the Destination Address of Ethernet frame. To provide enhanced error checking and avoid possible collisions.
Pure Converter with auto-change mode	To enhance transmission by changing packet forwarding speeds. It will change to forward mode if it detects the speed is different in TP port and FX port. For example, the TP port is 10 Mbps and Fiber port 100 Mbps Full Duplex. In this case the port will automatically change to store and forward mode.

#### Note

After changing the DIP Switch, please reset power to activate the function.

#### DIP Switch configuration

Pin No	Status	Description
DIP 1	On	Enable Link Loss Forwarding function (default)
	Off	Disable Link Loss Forwarding function
DIP 2	On	Set TX port in 100 Mbps Full Duplex mode
	Off	Set TX port in Auto-Negotiation mode (default)
DIP 3	DIP 4	Description
Off	Off	Store and Forward forwarding mode
Off	On	Pure converter forwarding mode (default)
On	Off	Modify Cut-Through forwarding mode
On	On	Converter Auto-Change forwarding mode
DIP 5	On	Enable power alarm
	Off	Disable power alarm (default)
DIP 6	On	Enable port alarm



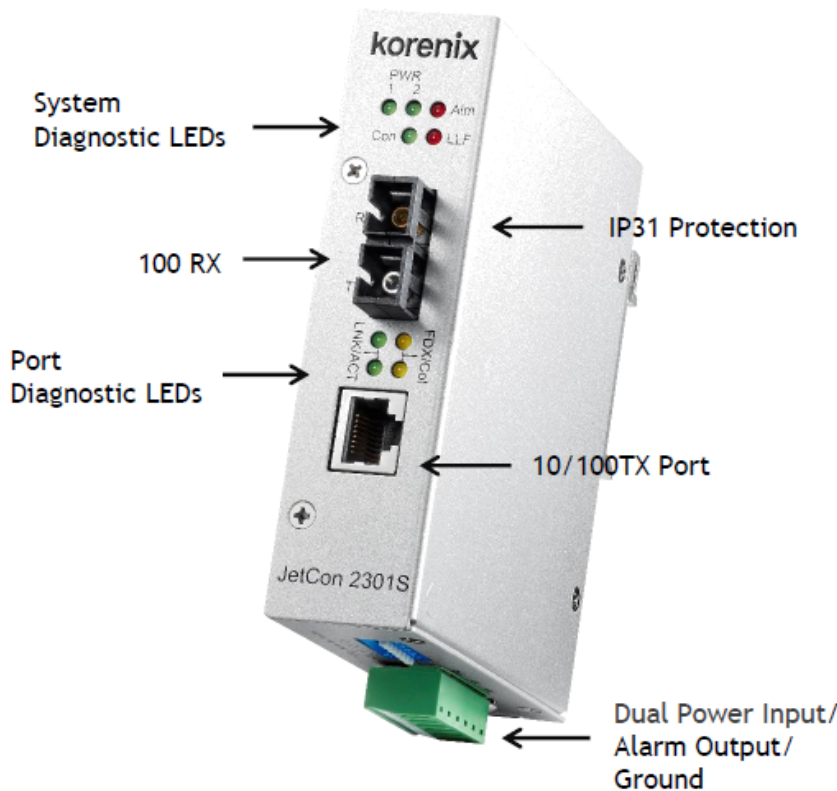
Default switch setting, suitable for EtherCAT (CRFX) operation.

#### EtherCAT (CRFX)



	Off	Disable port alarm (default)
DIP 7	On	Disable Flow control
	Off	Enable Flow control (default)

Front Panel of the device



The fiber optic converter JetCon 2301S (slimline) is the successor of the JetCon 2301. The JetCon 2301S is thinner than its predecessor in a [metal housing](#): 30 mm wide instead of 55 mm.

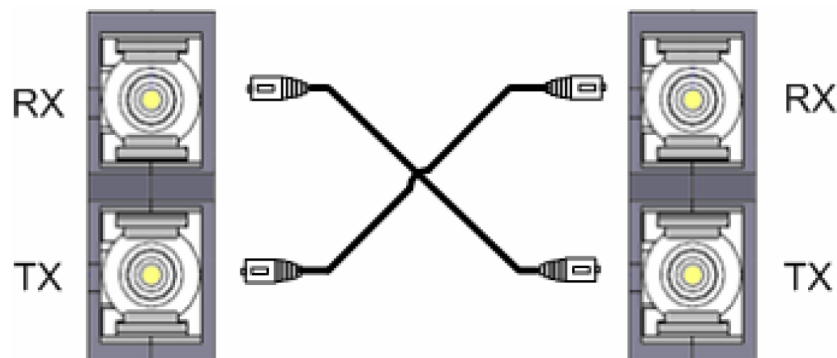
#### System LED indicators

The front panel includes 2 power LEDs, 1 LED for alarm indication, 1 LED for pure converter mode, 1 LED for Link Loss Forwarding indication and 4 LEDs for Ethernet port indication. The following table gives the descriptions of functions for each LED indicator.

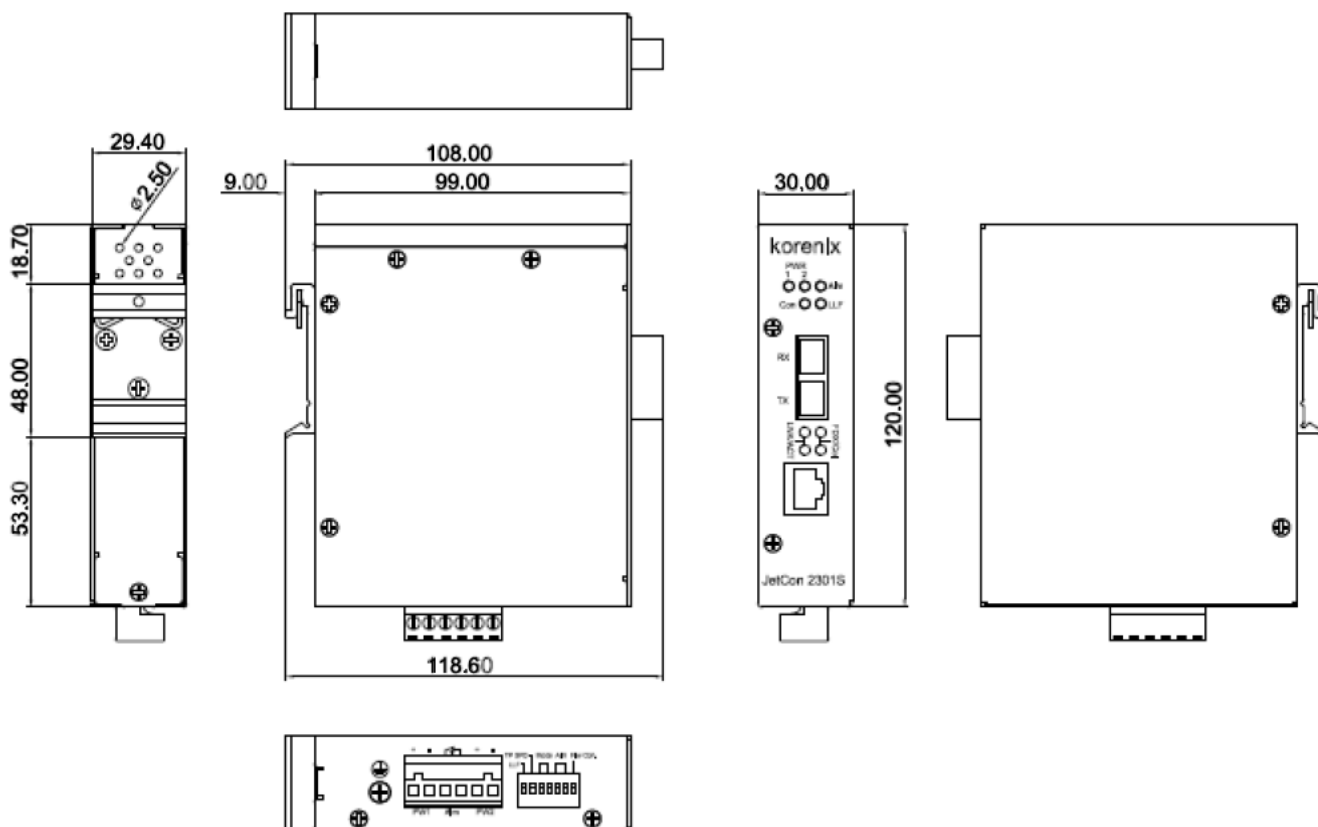
LED	Status	Description
PWR 1, 2	green on	power is on
Alm	red on	event alarm relay is active and forms a short circuit
Con	green on	device is working at pure converter mode
LLF	red on	port link down event has occurred and the other port is forced to link down
LNK/ACT	green on (LNK)	The Ethernet port is linked up and well connected with far end port.
	green blinking (ACT)	The Ethernet port is on communicating with far end port.
FDX/COL	yellow / amber on (FDX)	The port is linked with far end port at full duplex mode.
	yellow / amber blinking (COL)	packet collision has occurred with far end port

### Fast Ethernet Fiber port

The Fiber port supports IEEE 802.3u 100Base-FX standard for the single mode or multi-mode type fiber cable with different link distance. Before installing the fiber cable, please ensure that the cable type is matched with the specification of fiber transceiver. The following diagram shows how to install fiber cable between 2 fiber ports. The RX must cross connect with the remote device's TX port, as well as TX port must cross connect with remote device's RX port.



### Dimensions



### Optional accessories

- AC/DC power adaptor  
24 V DC / 60 W

order code: CAN/POWER-SUPPLY  
with PHOENIX connector

article no.: 10500022

## Technical Specs - FH/FO-CONV-ECAT-ENET-MM(-SM)

Parameter	Value	Remarks
Number of ports	1 (single converter)	
Compatible with	EtherCAT (IN and OUT)  EtherNET (LAN)	connect with internal system bus imc CRONOS <i>flex</i> connection between imc measurement device and the PC/network switch
Terminal connection		
Network	RJ45	
Fiber	Fiber port SC	
Power	plugable terminal block	
Standards	IEEE 802.3 10Base-T IEEE 802.3u 100Base-TX IEEE 802.3u 100Base-FX IEEE 802.3x Flow Control and Back Pressure	
Forwarding technology	pure converter  store and forward modify cut-through converter mode with auto negotiation	required setting for CRFX EtherCAT system bus  selectable via DIP-switch
Link Loss Forward	supports Bi-directional Link Loss Forwarding function	
TX Auto Sensing/Forced	RJ45 port supports auto-negotiation and forced mode 100 Mbps/Half Duplex	
Packet Length	64 to 1600 Bytes @ pure converter mode	
Forwarding Latency		
Pure Converter	1.6 $\mu$ s	(CRFX EtherCAT system bus)
Store and Forward	250 $\mu$ s	
Modify Cut-Through	17 $\mu$ s	
IEEE 802.3 flow control /back-pressure	enabled by DIP Switch	
Event Alarm	supports port link down and power event alarm relay output, controlled by DIP switch	
Digital Output	Dry Relay Output with 1A @ 24V DC ability	

General		
Parameter	Value	Remarks
Supply	10 V to 60 V DC with DC polarity protection	two redundant inputs
Power consumption	3 W	
Ingress Protection Rating	IP31	
Operating temperature	-40°C to +70°C	
Storage temperature	-40°C to +85°C	
Operating humidity	0% to 95%	non condensing
Dimensions (W x H x D)	30 x 120 x 99 mm	DIN rail mounting
Weight	0.40 kg	
Regulatory Approvals		
EMC	compliant with EN 50121-4 EMC	railway standard
EMI	EN55022 CLASS A, IEC/EN 61000-6-4	
EMS	CE/ EN 55024, IEC/EN 61000-6-2, IEC/EN 61000-4-2, IEC/EN 61000-4-3, IEC/EN 61000-4-4, IEC/EN 61000-4-5, IEC/EN 61000-4-6, IEC/EN 61000-4-8, IEC/EN 61000-4-9, IEC 61000-4-11	
Safety Hi-pot Testing	AC 1.5 kV	
Shock	IEC 60068-2-27	
Vibration	IEC 60068-2-6	
Free fall	IEC 60068-2-32	

FH/FO-CONV-ECAT-ENET-MM (13300017)		
Parameter	Value	Remarks
Fiber port type	Multi-Mode	
Link distance	2 km	
Wave-length	1310 nm	
Launch power	-20 dBm to -14 dBm	
Receive sensitivity	-31 dBm to 0 dBm	
Link budget	11 dBm	

FH/FO-CONV-ECAT-ENET-SM (13300038)		
Parameter	Value	Remarks
Fiber port type	Single-Mode	
Link distance	30 km	
Wave-length	1310 nm	
Launch power	-15 dBm to -8 dBm	
Receive sensitivity	-34 dBm to 8 dBm	
Link budget	19 dBm	