

## DATA SHEET

# MXFS DI QuantumX BraggMETER Interrogator Module

## SPECIAL FEATURES

- Parallel measurements of up to 128 FBG sensor channels
- NTP and PTP synchronization
- 100 nm measurement range
- 2000 S/s and 100 S/s acquisition rates
- Smart Peak Detection (SPD)
- Delivered with catman® software
- EN45545 and ATEX certified



## DESCRIPTION

The MXFS DI BraggMETER module is an optical interrogator based on the QuantumX platform. The compatibility with the QuantumX family adds to fiber Bragg grating (FBG) measurements the possibility of including any other type of sensors in the same sensing network, as well as the generation of analog/digital control signals and the use of most common industrial protocols.

BraggMETER interrogators employ proven continuous swept laser scanning technology that includes a NIST

traceable wavelength reference, providing continuous calibration to ensure system accuracy over long term operation. The high dynamic range and output power combined with Smart Peak Detection allow high resolution to be attained even for long fiber leads and lossy connections. Delivered together with the powerful catman®Easy software for data acquisition, analysis, visualization and storage.

## BENEFITS AND APPLICATION

### Interrogator

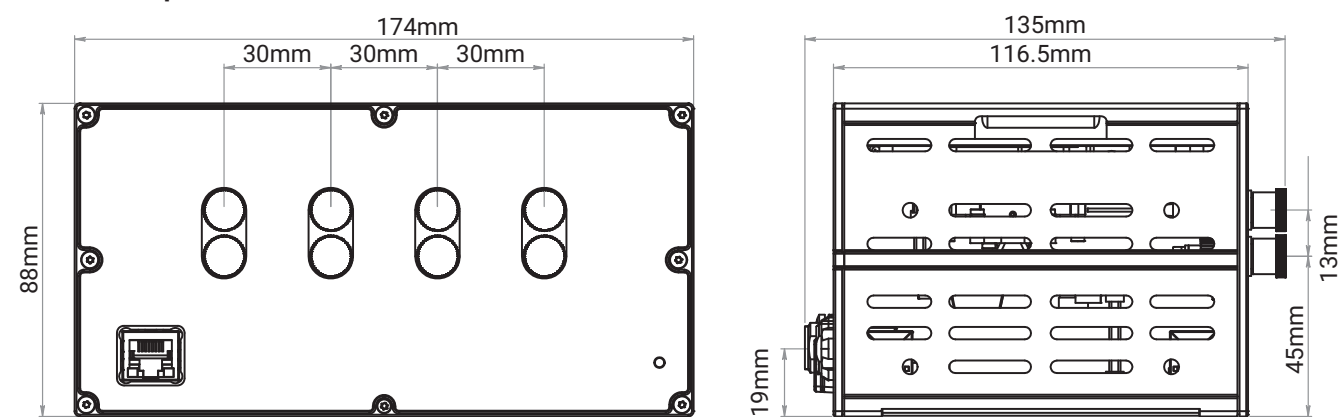
- Modular design of the QuantumX platform, combinable with all modules
- Compatible with catman® software
- Drivers for connecting to third party software
- Small size and weight for mobile applications
- EN45545 certified for fire safety and ATEX certified for explosive atmospheres
- Two different laser sweeping rates ensuring best fitting to different applications
- Monitoring of Civil structures, wind turbines, ship hulls or railways

### Fiber Bragg grating technology

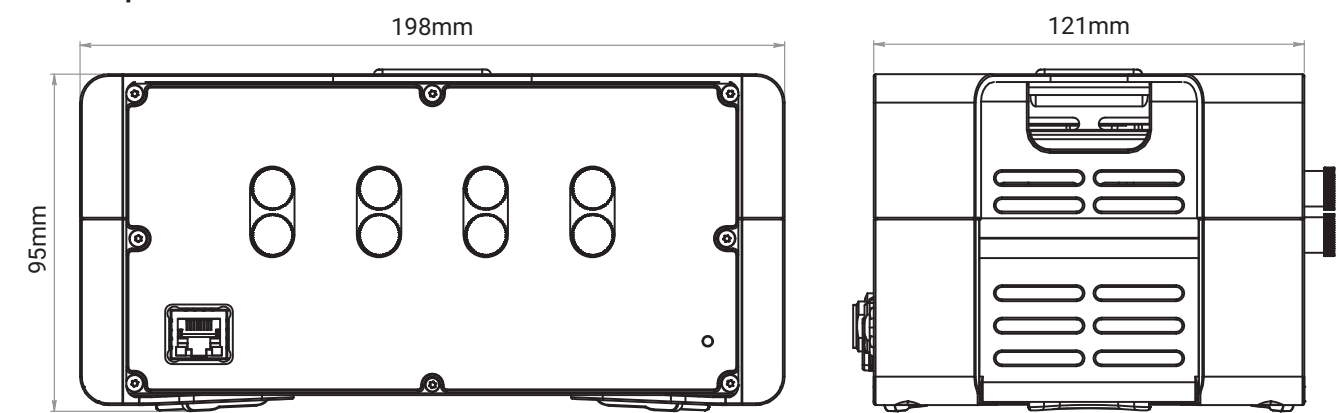
- Absolute reference measurement
- Insensitive to EM/RF interferences
- Passive (can be used in risk explosion areas)
- Intrinsic multiplexing capability reducing cabling requirements
- Long distances between sensors and interrogators
- Different sensor measurands per optical connector (e.g. strain, temperature, acceleration, tilt, displacement, load...)

TECHNICAL DRAWINGS

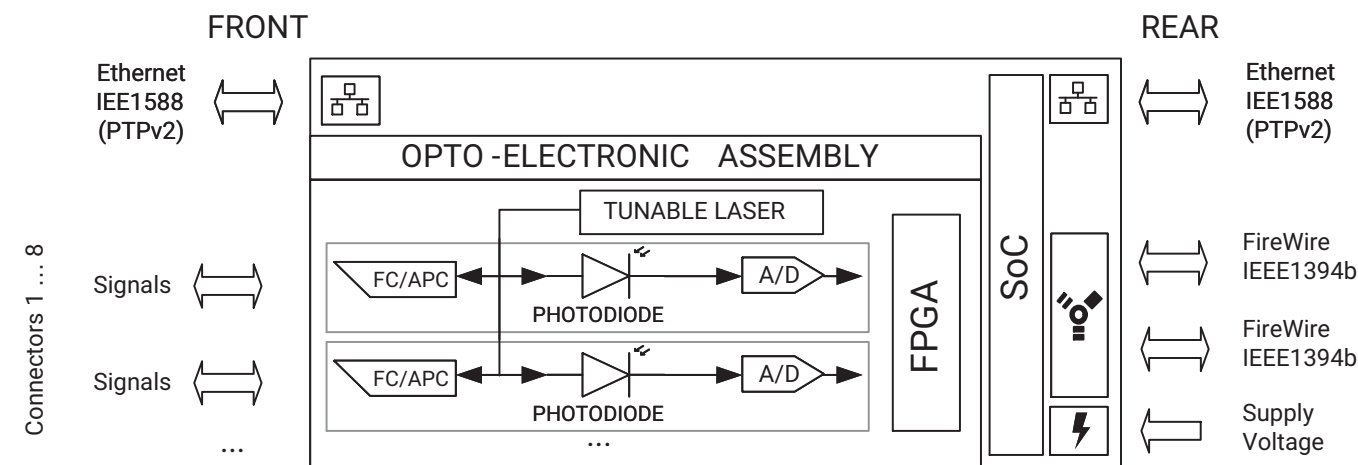
Without case protection



With case protection



BLOCK DIAGRAM



		High speed mode	Low speed mode
<b>General specifications</b>			
<b>Inputs</b>	-	8	
<b>Connector types</b>	-	FC/APC	
<b>Transducer types</b>	-	Any, based on Fiber Bragg Grating (FBG)	
<b>Output options</b>	-	Relative Wavelength, Absolute Wavelength, Strain, Temperature <sup>1)</sup> , Acceleration, General polynomial <sup>1)</sup>	
<b>Optical wavelength measurement range</b>	nm	1,500 to 1,600 [100]	
<b>Number of channels per optical connector</b>	-	16	
<b>Sample rate<sup>2)</sup></b>	S/s	2,000	100
<b>Output rate</b>	S/s	0.1 ... 2,000	0.1 ... 100
<b>Signal bandwidth (-3 dB)</b>	Hz	800	17.5
<b>Resolution/Repeatability<sup>3)</sup></b>	pm	<0.5	<1
<b>Stability/Reproducibility<sup>3)</sup></b>	pm	2	3
<b>Peak detection method</b>	-	SPD <sup>4)</sup>	
<b>Dynamic range<sup>5)</sup></b>	dB	>20	>22
<b>OSA<sup>6)</sup></b>	-	Yes	
<b>Optical Output Power per connector</b>	dBm	-5 (typical) -3 (maximum)	
<b>Active filters</b>	Hz	Bessel, Butterworth, linear phase 0.01 ... 20 (-3 dB), filter OFF	
<b>Supply voltage</b>	V	12 ... 30 (24 V nominal (rated) voltage)	
<b>Power supply interruption</b>	-	Max. 5 ms at 24 V	
<b>Power consumption</b>			
At start up (20 s)	W	35	
Nominal	W	18	
<b>Ethernet (data link)</b>		10Base-T/100Base-TX	
Protocol/addressing	-	TCP/IP (direct IP address or DHCP)	
Connection	-	8P8C plug (RJ-45) with twisted pair cable, Streaming (CAT-5)	
Max. cable length to module	-	100	
<b>Synchronization<sup>7)</sup></b>			
FireWire	-	IEEE1394b (2 ports per device)	
Ethernet	-	IEEE1588 (PTPv2) or NTP (2 ports per device)	
<b>IEEE1394b FireWire (module synchronization, data link, optional supply voltage)</b>		IEEE1394b (HBK modules only)	
Baud rate	MBaud	400 (approx. 50 Mbyte/s)	
Max. current from module to module	A	1.5	
Max. cable length between nodes	M	5	
Max. number of modules connected in series (daisy chain)	-	12 (=11 Hops)	
Max. number of modules in a IEEE1394b Firewire system (including hubs <sup>8)</sup> backplane)	-	24	
Max. number of hops <sup>9)</sup>	-	14	

1) Third order polynomial of the type  $ax^3+bx^2+cx+d$

2) User selectable. Changing the speed mode will restart the device.

3) Measurements carried out using calibrated instrument against NIST traceable gas cell. Accuracy as per NIST Technical note 1297. Resolution/repeatability measured as  $\sigma$  value at room temperature over the full wavelength range for 1 min. Stability/Reproducibility measured as  $|\mu|+\sigma$  value over full temperature range and over full wavelength range for more than 50 h. Measurements taken without any filtering and with relative wavelength values. Further details on HBK FiberSensing technical notes.

4) Smart Peak Detection. Allows optimum management of multiple FBG with different losses/reflectivities in a single connector. For further details please refer to HBK FiberSensing technical notes.

5) Measured as the admissible loss of a FBG peak that still ensures a measurement repeatability <5 pm.

6) Optical Spectral Analysis available at both speed modes (0.5 S/s refresh rate; 10000 points per trace).

7) EtherCAT® available via CX27 gateway module and IRIG-B available via MX440B or MX840B.

8) Hub: IEEE1394b FireWire node or distributor.

9) Hop: Transition from module to module/signal conditioning.

		High speed mode	Low speed mode
<b>Environmental and mechanical</b>			
<b>Operating temperature range</b>	°C [°F]	-20 ... +50 [-4 ... +122]	
<b>Storage temperature range (EN60068-2-1; EN60068-2-2, EN60068-2-14)</b>	°C [°F]	-40 ... +75 [-4 ... +167]	
<b>Relative humidity</b>	%	5 ... 95 (non-condensing)	
<b>Mechanical tests<sup>10)</sup></b>			
Sinusoidal Vibration		EN60068-2-6	API 17f (Q2)
Acceleration	g <sub>0</sub> -PK	2	5
Duration per axis	min	160	10
Frequency	Hz	10 ... 150	5 ... 150
Random Vibration		EN60068-2-64	API 17f (Q2)
Acceleration	g <sub>RMS</sub>	1.87	6
Duration per axis	min	30	120
Frequency	Hz	10 ... 500	20 ... 2000
Shock resistance		EN60068-2-27	API 17f (Q2)
Acceleration	g <sub>0</sub> -PK	15	10
Pulse Duration	ms	6	11
Number of impacts		600	24
<b>EMC requirements</b>	-	Per EN61326	
<b>Fire Safety (EN45545-2)</b>	-	Hazard levels HL1, HL2 and HL3, according to EN45545-2:2016 and DIN EN45545-2:2020 (without case protection)	
<b>ATEX (EN60079-28) IECEx (IEC60079)</b>	-	The device must be erected outside of the explosive atmosphere. The interrogator has been approved according to the EN60079-28:2015, IEC60079-0:2017 and IEC60079-28:2015 for: II (1)G [Ex op is IIC T6 Ga] Zone 0 for gas group IIC II (1)D [Ex op is IIIC Da] Zone 20 for dust group IIIC I (M1) [Ex op is I Ma] Zone M1 for mining	
<b>Dimensions, horizontal (w x h x d)</b>	mm	198 x 95 x 135 (with case protection) 174 x 88 x 135 (without case protection)	
<b>Weight</b>	kg	1.7(with case protection) 1.5 (without case protection)	
<b>Degree of protection (EN60529; IEC529)</b>	-	IP20	

<sup>10)</sup> Device turned on and measuring. No communication losses observed. Tests passed with criteria A - no degradation on measurement - and B - outliers observed, but returning to normal behavior after test. for further details please contact HBK FiberSensing.  
API 17f is a specific Standard for Subsea Production Control Systems from the American Petroleum Institute ([www.api.org](http://www.api.org)).

## SOFTWARE, INCLUDED

Article	Description	Order no.
<b>catman® Easy</b>	Test and measurement software for system configuration, data acquisition, analysis, visualization and storage. Includes maintenance for 12 months.	1-CATMAN-EASY

## SOFTWARE, TO BE ORDERED SEPARATELY

Article	Description	Order no.
<b>catman® Easy to AP upgrade<sup>11)</sup></b>	Software upgrade: catman Easy to catman AP full version. Only possible with a registered catman Easy version and valid maintenance contract. License key for activation is delivered by e-mail.	1-CATEASY-TO-AP
<b>catman® AP<sup>11)</sup></b>	All-inclusive package, comprising catman® Easy Functionality plus add-on modules such as video camera integration (EasyVideoCam), full post-process analysis (EasyMath), recurrent activity automation (EasyScript), measurement project preparation offline (EasyPlan), and additional functions such as electrical power calculation, special filters, frequency spectrum, etc. Details at <a href="https://www.hbkworld.com/pt/products/software/daq">https://www.hbkworld.com/pt/products/software/daq</a>	1-CATMAN-AP
<b>catman® PostProcess</b>	PostProcess edition for visualization, analysis and processing of measurement data with many mathematical functions, data export and reporting.	1-CATEASY-PROCESS
<b>LabVIEW™ driver</b>	Universal driver from HBK for LabVIEW™	1-LabVIEW-DRIVER

<sup>11)</sup> MXFS DI is compatible with catman version 5.4.1 or higher

## ACCESSORIES, TO BE ORDERED SEPARATELY

Article	Description	Order No.
<b>Power</b>		
AC-DC power supply / 30 W	Input : 100 ... 240 V AC ( $\pm 10\%$ ), 1.5 m cable Output: 24 V DC, max. 1.25 A, 2 m cable with ODU connector	1-NTX001
3m cable - QuantumX supply	3 m cable for voltage supply of QuantumX modules; Suitable plug (ODU Medi-Snap S11M08-P04MJGO-5280) on one side and open strands on the other end.	1-KAB271-3
<b>Communication</b>		
Ethernet cable	Ethernet patch cable for direct operation between a PC or Notebook and a module / device, length 2 m, type CAT6A	1-KAB239-2
IEEE1394b FireWire cable (module-to-module)	FireWire connection cable for QuantumX or SomatXR-modules; with matching plugs on both sides. Length 0.2 m (angled) / 2 m / 5 m Note: The cable enables QuantumX modules to be supplied with power (max. 1.5 A, from the source to the last drain).	1-KAB272-W-0.2 1-KAB272-2 1-KAB272-5
<b>Mechanic</b>		
Connecting elements for QuantumX modules	Connecting elements (clips) for QuantumX modules; Set comprising 2 case clips including mounting material for fast connection of 2 modules.	1-CASECLIP
Connecting elements for QuantumX modules	Fitting panel for mounting of QuantumX modules using case clips (1-CASECLIP), lashing strap or cable tie. Basic fastening by 4 screws.	1-CASEFIT
QuantumX Backplane (big)	QuantumX Backplane for a maximum of 9 modules - Mounting on wall or control cabinet (19") - Connection of external modules by FireWire possible - Power supply: 18 ... 30 V DC / max. 5 A (150 W)	1-BPX001
QuantumX Backplane (Rack)	QuantumX Backplane - Rack for maximum 9 modules - 19" rack mounting with handles left and right - Connection of external modules via FireWire possible - Power supply: 18 ... 30 V DC / max. 5 A (150 W).	1-BPX002
QuantumX Backplane (small)	QuantumX Backplane for a maximum of 5 modules - Connection of external modules by FireWire possible - Power supply: 11 ... 30 V DC / max. 3.75 A (90 W)	1-BPX003

## SPECIFICATIONS POWER PACK NTX001

NTX001		
Nominal input voltage (AC)	V	100 ... 240 ( $\pm 10\%$ )
Stand-by power consumption at 230 V	W	0.5
Nominal load		
U <sub>A</sub>	V	24
I <sub>A</sub>	A	1.25
Static output characteristics		
U <sub>A</sub>	V	24 $\pm$ 4%
I <sub>A</sub>	A	0 ... 1.25
U <sub>Br</sub> (Output voltage ripple; peak to peak)	mV	$\leq 120$
Current limiting, typically from	A	1.6
Primary - secondary separation		galvanically, by optocoupler and converter
Creep distance and clearance	mm	$\geq 8$
High-voltage test	kV	$\geq 4$
Plugs and cables	-	international plugs
Ambient temperature range	°C [°F]	0... +40 [+32 ... +104]
Storage temperature	°C [°F]	-40 ... +70 [-40 ... +158]

## ORDERING INFORMATION

Description	Order no,
QuantumX BraggMETER Interrogator Module with Dynamic sampling rates and 8 FC/APC Optical Connectors	1-MXFS8DI1/FC

### HBK FiberSensing S.A.

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