

# 400G Power Blazer Series

## MULTISERVICE TEST MODULE



Most compact 400G multiservice test modules for lab and field applications

SPEC SHEET

### KEY FEATURES AND BENEFITS

400G Ethernet testing capabilities based on the IEEE 802.3bs standard

State-of-the-art Open Transceiver System (OTS) design for full flexibility with current and future transceivers

Flex Ethernet (FlexE) testing capabilities with low and high speed Ethernet clients supported on 4xQSFP28 ports

Flexible solution that uniquely supports CFP8, QSFP-DD and OSFP interfaces without adapters

Compatible with EXFO's LTB-8 Rackmount Platform featuring hot-swap capability for lab use and best-in-class 400G port density with up to two modules running simultaneously

Compatible with the portable FTB-4 Pro Platform to release the most compact 400G solution—ready for the lab-to-field transition

Supported by EXFO Multilink, a web-based application for easy multi-user management and remote access

Supports quick optical transceiver validation and sanity check using iOptics, an intelligent pluggable optics test application

Unframed BERT capabilities including the most important patterns: PRBS31Q, PRBS13Q and SSPRQ

Pre-emphasis and RX equalization tools to modify the waveform for better eye opening at the destination

PAM4 histogram: provides a graphic view from PAM4 eye diagram per lane, including PAM4 levels

### RELATED PRODUCTS AND ACCESSORIES



**Rackmount Platform  
LTB-8**



**Platform  
FTB-4 Pro**



**Multi-User Interface  
EXFO Multilink**



## 400G TO THE RESCUE

Network infrastructure planners must deal with skyrocketing demands for more bandwidth, including in the data center interconnect (DCI) or even in core and metro networks. Network equipment manufacturers (NEMs) continue to push the limits of technology, developing increasingly innovative 400G solutions. Service providers are constantly expanding their networks, looking for more efficient and cost-effective ways to deploy those high-speed circuits. High-speed transceivers (pluggables) are being designed to be smaller and consume less power in order to meet the requirements of delivering high port density at a low cost. In the upcoming 400G world, transceiver testing is of critical importance whenever we are talking about QSFP-DD, OSFP, or even COBO.

The industry is moving forward with smaller, advanced transceivers for shorter wavelengths and with lower power consumption. EXFO offers 400G solutions that are ready for today's 400G transceivers while being future-proof. 400G switches are migrating quickly to advanced technologies with interfaces that will allow them to increase the port density in a 1RU at minimal cost.

## COMPATIBLE WITH PORTABLE AND RACKMOUNT PLATFORMS

The new, compact FTBx-88400NGE and FTBx-88460 Power Blazer modules offer a complete suite of 400G ecosystem testing capabilities, addressing early adopters' requirements from in-lab innovation to testing in the field. In addition, when portability is needed the FTBx-88400 Series module can be inserted into the FTB-4 Pro. The module can also serve for rackmount applications, where not only one but two modules can be inserted into the high-performance LTB-8 rackmount chassis to deliver up to 800G of Ethernet traffic. The LTB-8 rackmount platform provides users with added versatility and power for today's complex networks.

### 400G TESTING MODULE

#### FTBx-88400NGE Power Blazer

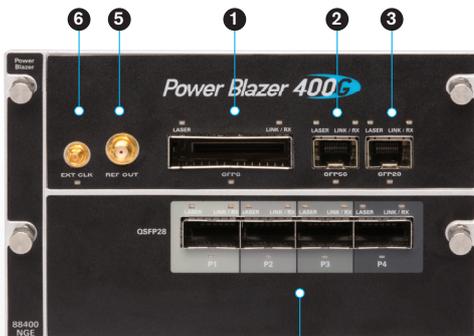


The 400G high-speed module is based on IEEE 802.3bs with RS (544,514) FEC capabilities. Ethernet testing including 400G Ethernet using a CFP8 port with MAC/IP/UDP and PCS layer support in addition to advanced FlexE with multiple QSFP28 ports for intra-data center and router-to-transport applications. This module is also OTUCn and FlexO (Flex OTN)-ready.

#### FTBx-88460 Power Blazer



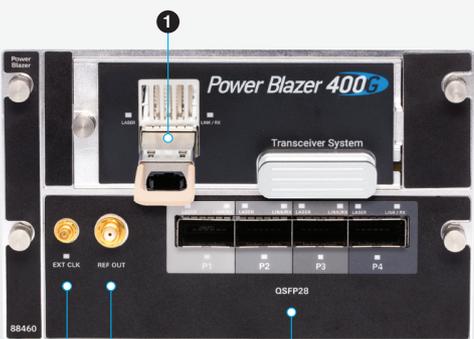
The FTBx-88460 offers same power and advanced 400G ecosystem testing, as the FTBx-88400NGE. The addition of the Open Transceiver System makes it uniquely suited to adjust to the specific transceiver required for the test.



FTBx-88400NGE Power Blazer

### DESIGNED FOR EFFICIENCY

- 1 CFP8 interface supporting 400G
- 2 SFP56 interface
- 3 SFP28 interface
- 4 4 x QSFP28 ports supporting FlexE and OTUCn/FlexO up to 400G
- 5 REF CLOCK OUT SMB interface
- 6 Synchronization SMA interface



FTBx-88460 Power Blazer

### DESIGNED FOR FLEXIBILITY

The Open Transceiver System design provides enhanced flexibility and CAPEX protection to the end user; one test module can support various types of transceivers. A flexible solution that can adapt and adjust to the fast evolution of transceivers while providing multirate support.

The FTBx-88460 can also be configured with only a filler for FlexE and FlexO testing applications.

- 1 400G transceiver
- 2 4 x QSFP28 ports supporting FlexE and OTUCn/FlexO up to 400G
- 3 REF CLOCK OUT SMB interface
- 4 Synchronization SMA interface





QSFP-DD



CFP8



QSFP28



OSFP

**INTERFACES**

QSFP28	SR4/LR4/CWDM4/CLR4/PSM4	100 Gbit/s QSFP quad form-factor pluggable
CFP8	FR8/LR8	400 Gbit/s SMF (400GAUI-8) optical 8 x 50G PAM-4
QSFP-DD	FR8/LR8/FR4/DR4	400 Gbit/s SMF (400GAUI-8) optical 8 x 50G /4 x 100G PAM-4
OSFP	FR8/LR8/FR4/DR4	400 Gbit/s SMF (400GAUI-4) optical 8 x 50G /4 x 100G PAM-4

**TESTING UP TO 800G ETHERNET LINKS SIMULTANEOUSLY**

**Multiple configurations available**

- > 2 x QSFP-DD
- > 2 x OSFP
- > 2 x CFP8
- > 1 x QSFP-DD – 1 x OSFP
- > Up to 8 x QSFP28 FlexE testing



**RAPID EVOLUTION OF TRANSCEIVERS**

A shared challenge in the telecom industry today is the large number of various pluggable transceivers available and the rapid rate at which new types of transceivers are being launched. This growing challenge impacts equipment manufacturers trying to keep up as well as network operators/data centers trying to integrate new transceivers into their networks.

With that in mind, the latest addition to the Power Blazer family of test modules—the FTBx-88460—comes with a new design concept using Open Transceiver System which allows users to customize the type of interfaces on the module according to their needs, without using adapters, while also ensuring the future-proof capacity to test new transceivers as they become available, by simply changing the transceiver system instead of having to purchase a new test unit.



## 400G ETHERNET

400G Ethernet is the promising replacement for 100G Ethernet. 400G is becoming the next client rate in the Ethernet ecosystem as the industry ramps up to handle the massive demands of hyperscale data centers, service providers and business users. The FTBx-88400 Series offers advanced Ethernet testing capabilities, including forward error correction monitoring and validation.

### 400G framed/unframed Ethernet testing capabilities

- › 400G Ethernet MAC PCS/PMA/PMD layer testing
- › FEC RS (544,514) decoding and error correction
- › Test pattern monitoring
- › MDIO read/write
- › Alarms/errors generation and monitoring
- › Per lanes PRBS unframed testing with pass/fail verdict

### Advanced testing capabilities

- › Skew measurement per lane
- › FEC testing
- › BER monitoring
- › Advanced error analysis
- › SDT measurement
- › Ethernet traffic filtering
- › Unframed BER testing (including PRBS31Q, PRBS13Q and SSPRQ patterns)
- › Pre-emphasis and RX equalizer for the capability to modify the signal for better eye opening
- › PAM4 histogram



### Unframed BERT



iOptics is an intelligent pluggable optics test application and first-alert test that can be used in the field or lab environment to efficiently evaluate the proper operation of an optical interface, with minimal user configuration required. iOptics performs the validation using several subtests, monitors power consumption and temperature and reports an individual verdict for each subtest and monitoring task. iOptics now supports the latest high-speed pluggables including 400G/100G transceivers, AOC and DAC cables.

100G: QSFP28



100G: AOC cables



400G: CFP8



400G: QSFP-DD



400G: DAC cables



## FlexE (FLEX ETHERNET)

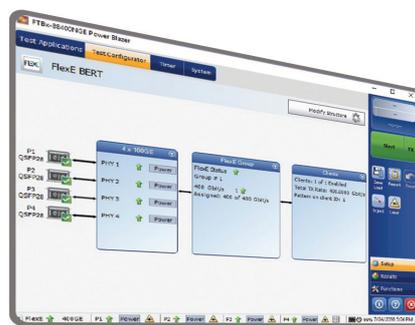
The Flex Ethernet (FlexE) supports one or more bonded 100GBASE-R PHYs supporting multiple and mixed Ethernet MAC clients operating at rates of 5, 10, 25, 40, 50, 100 or up to 400 Gbit/s. Flex Ethernet is a key technology for data centers, helping them deliver links that are faster than emerging 400G solutions. It will also support sub-rate links i.e., 10G, 25G and 50G, which are essential for data centers but also for carriers that need to isolate their traffic.

### FlexE testing capabilities

- > FlexE group
- > Mixed Ethernet client types
- > Client ID edition
- > FlexE shim configuration
- > FlexE alarms/errors generation and monitoring
- > Alignment marker corruption and substitution
- > Full client to calendar slot assignment edition capabilities



Ethernet multiclients



400GE single client

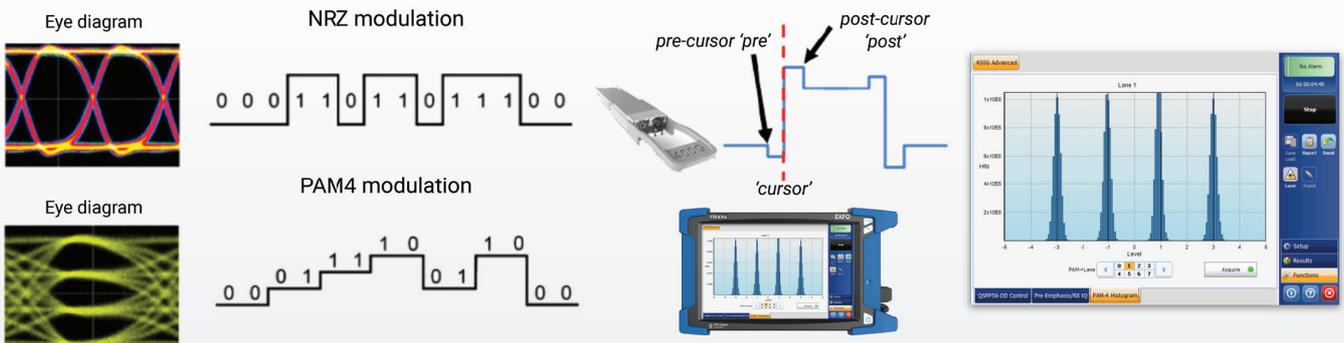


Calendar overview

## IMPROVING THE TRANSMISSION SIGNAL

The adoption of PAM-4 (which stands for pulse amplitude modulation) as the new modulation for current and future interfaces on the high speed market brings new challenges, PAM-4 electrical eyes are smaller in comparison to the typical modulation used for 100G non-return-to-zero (NRZ) technologies.

The characteristics of this modulation may generate a less efficient OSNR. Lab technicians require tools to manipulate the transmission signal and improve the eye diagram making it more visible. High speed technologies require options to modify the pre- and post-cursor on the electrical waveform; amplifying or attenuating of the edges helps to define the signal as it leaves the transceiver for better performance.



EXFO's pre-emphasis and RX equalizer tools help users adjust and manipulate the signal characteristics for TX (cursor and eye location) and RX (including different types of DSP modes) validating each lane of the pluggable under test. Once these parameters are modified, users need to identify the impact these parameters have over the PAM4 eye diagram. Our PAM4 histogram tool provides a detailed graphical view of each lane diagram directly on the screen of the tester, showing values for each PAM4 level.



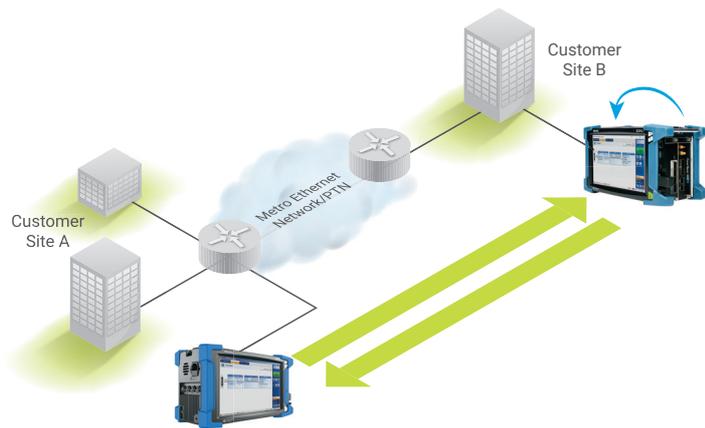
## RFC 2544

As 400G market moves from lab to field (the first 400G deployments are around the corner), ensuring service quality at turn-up is becoming key. Portable 400G test equipment will enable field technicians and contractors to immediately capture test results and demonstrate that the Ethernet service meets SLAs. These tests may also serve as a performance baseline for future reference.

From a laboratory and benchmarking perspective, the RFC 2544 methodology is ideal for automated measurement and reporting. From a service turn-up and troubleshooting perspective, RFC 2544 provides an out of service benchmarking methodology for evaluation of network/device performance using four subtests, each validating a specific portion of an SLA. RFC 2544 provides engineers and network technicians with a common language and results format.

### RFC2544 includes the following subtests:

- 1 Throughput
- 2 Back-to-back (Burstability)
- 3 Frame loss
- 4 Latency



## SOFTWARE TEST TOOLS

These platform-based software testing tools enhance the value of the LTB-8 and FTB-4 Pro platforms, providing additional monitoring and inspection testing capabilities.

### SOFTWARE APPLICATIONS

Connect<sup>or</sup>Max2

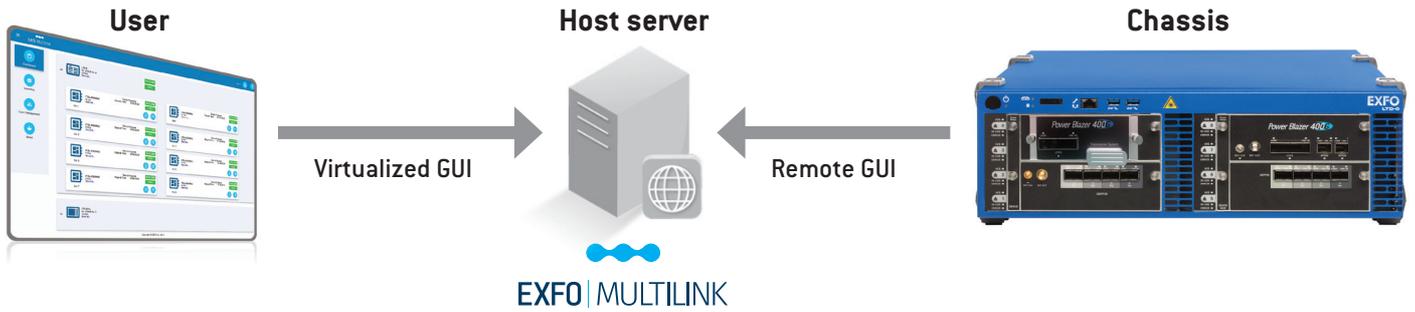
Providing lightning-fast results in the first step of fiber link testing, ConnectorMax2 is a powerful platform-based, automated inspection application. It delivers quick pass/fail assessment of connector endfaces and is designed to save time and money, in the field and in the lab.

**EXFO**



## EXFO | MULTILINK

The value of connectivity comes from the ability to connect your platform anywhere, at any time. The EXFO Multilink **multi-module**, **multi-user** and **multi-chassis** application enables the remote control access of each chassis and module through a centralized network.



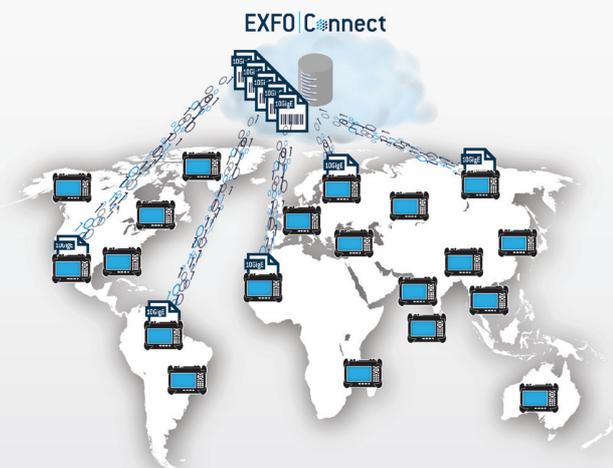
## EXFO | C<sub>o</sub>nnect

### EXFO CONNECT MAKES YOUR DATA MEAN BUSINESS

EXFO Connect completely redefines integrated testing with its cloud-hosted solution. Equipped with powerful database and application technologies, EXFO Connect provides an automated, secure environment that links together your EXFO test instruments and centralizes your test reports.

#### Test Equipment Manager

EXFO Connect's Test Equipment Manager is an automated application that centralizes the management of all EXFO test instruments. A repository for software loads, licenses and platform profiles, it helps managers handle the constant demand for software updates. It also keeps track of equipment and ensures field technicians are equipped with up-to-date capabilities.



#### FTB Anywhere: Floating Test Licenses

FTB Anywhere™ is a shared test-license capability for the award-winning FTB Ecosystem. This unique approach to delivering advanced test applications enables network operators to purchase a specific number of cloud-hosted licenses that can be shared instantly with their technicians, wherever they happen to be.



## MECHANICAL AND ENVIRONMENTAL SPECIFICATIONS

	FTBx-88400NGE Power Blazer module	FTBx-88460 Power Blazer module
Size (H x W x D)	101 mm x 159 mm x 175 mm (4 in x 6 1/4 in x 6 7/8 in)	101 mm x 159 mm x 175 mm (4 in x 6 1/4 in x 6 7/8 in)
Weight	1.70 kg 3.75 lb	1.70 kg 3.75 lb <sup>a</sup>
Temperature	Operating Storage	Operating Storage
	0 °C to 40 °C (32 °F to 104 °F) -40 °C to 70 °C (-40 °F to 158 °F)	0 °C to 40 °C (32 °F to 104 °F) -40 °C to 70 °C (-40 °F to 158 °F)

## REF-OUT INTERFACE

Tx pulse amplitude	Min: 200 mVpp Max: 1300 mVpp
Transmission frequency	155 MHz to 3.50 GHz
Output configuration	AC-coupled
Load impedance	50 Ω
Connector type	SMA
External cable	Maximum 1 meter cable length (RG178 cable with 3.1 dB/m attenuation at 3.5 GHz)

**Note**

a. With filler



## SUMMARY OF KEY FEATURES

Detailed compliance testing	IEEE 802.3ba and IEEE 802.3bs standard
Multi-interface support	Pluggable MSA-compliant 4 x 25G QSFP28 transceivers AOC QSFP28 cable support CFP MSA management interface specification version 2.6 (R06a) QSFP-DD MSA revision 4.0, 8 x 50G and 4 x 100G OSFP MSA revision 2.0, 8 x 50G and 4 x 100G DAC cables support
Line rate	425 Gbit/s
400G ecosystem support	400GbE, FlexE and OTUCn and FlexO
Robust physical-layer validation	400GAUI lane-error generation and monitoring PCS lane mapping and monitoring capability Per-lane skew generation and measurement PCS error generation and monitoring per lane Full MDIO/I2C read/write access
Transceiver and cable validation	QSFP28, CFP8 and QSFP-DD
iOptics	Optical-device I/O interface quick check Optical TX power-level test Optical RX signal-presence and level test Stress test Excessive skew test Temperature and power consumption monitoring
Power measurement	Optical channel power measurement with color indicators per lane
Frequency measurements	Allow users to measure the received frequency per wavelength (in Hz) in the used of parallel optics
Frequency offset	Offsetting of the transmitted signal's clock on a selected interface, and monitoring
BERT	BERT framed and unframed testing using different parameters
Service disruption time (SDT)	Service disruption time measurements based on no traffic, mode, with statistics including longest disruption time, shortest, last, average, count, total and pass/fail thresholds
Error injection mode	Manual, rate and continuous (maximum rate)
Layer 2	MAC address and Ether type edition available Q-in-Q capability with the ability to go up to three layers of stacked VLANs
Layer 3/4	Source and destination IP address configuration available IP TOS/DSP configuration available UDP source and destination port configuration available
RFC 2544	Throughput, back-to-back, frame loss and latency measurements according to RFC 2544; frame size: RFC-defined or user-configurable
Smart loopback	Return Ethernet traffic to the local unit by swapping packet overhead up to layer 4
Rx frame-size analysis	< 64, 65 - 127, 128 - 255, 256 - 511, 512 - 1023, 1024-1518 and > 1518
Rx rate	Line utilization (%), Ethernet BW (Mbit/s), frame rate (frame/s), and frame count
Ethernet alarms	Link down, local fault detected, local fault received, remote fault, LOA
Ethernet errors	FCS, jabber, runt, undersize and oversize
Higher layer error analysis	UDP checksum
PCS lane alarms and errors	LOS, LOC-lane, LOAML, excessive skew, Inv. Marker, Pre-FEC SYMB and Pre-FEC-bit
Skew insertion	Per-lane skew generation and measurement range 0 to 10550
PCS logical lane mapping	Manual and random
FEC	Generation and analysis of FEC correctable and uncorrectable errors, local and remote degraded SER monitoring
FEC statistics	Number of symbol errors per correctable codeword, number of pre-FEC symbol errors, codeword count (error-free and uncorrectable) and percentage
PAM4 histogram	Provides a graphic view from PAM4 eye diagram per lane, including PAM4 levels
Pre-emphasis	Pre-/main-/post- cursor, lower/upper eye and swing (%) options to improve electrical waveform
IP tools	Performs ping and traceroute functions
Advanced filtering	Configure up to 10 filters, each with four fields that can be combined with AND/OR/NOT operations; a mask is also provided for each field value with IPV4 capabilities
Remote access	Supported via EXFO Remote ToolBox, Remote Desktop, VNC and EXFO Multilink for multiuser support
Automation	Wide range of commands available per application to allow test automation



## UNFRAMED BER TEST

Pattern configuration	16 unframed 400GAUI-16 lanes, 16 unframed 400GAUI-8 lanes and 8 unframed 400GAUI-8 lanes
PRBS patterns per lane	Allow users to configure different PRBS patterns on different 400GAUI lanes
Patterns	PRBS 2E31-1, PRBS 2E23-1, PRBS31Q, PRBS13Q, SSPRQ capability to invert patterns
Error measurement	Mismatch 0, mismatch 1, bit error and pattern loss per 400GAUI lane displayed in seconds, count and rate
Alarm injection	Capabilities to inject pattern loss and LOS per 400GAUI lane continuously

## FLEX ETHERNET

Compliance	Compliant to OIF
Multi-interface support	Four QSFP28 ports available to configure FlexE traffic up to 400G
RS-FEC support	RS-FEC capabilities per port
Skew monitoring	Graphical skew monitoring per port
Skew insertion	Per-port skew generation and measurement range 0 to 2047
PHY number	FlexE PHY number per port edition available
Group number	FlexE group number edition available
Client	Client ID and Mac address edition available per client
Calendar type	Calendar A/B configuration and monitoring
Calendar edition	Graphical calendar configuration per slot/client/clients for FlexE bonding, sub-rate and channelization
Clients available	Different client configuration included 5GE, 10GE, 40GE, 50GE, 100GE, 150GE, 200GE, 250GE, 300GE, 350GE and 400GE
Ports capacity	Display the calendar used, unused and assigned capacity in Gbit/s
Client statistics	Size, TX and RX rate in Gbit/s, frame count
BERT	Selectable FlexE client bit error rate analysis using a specific pattern
BER error injection	Manual, rate and continuous (maximum rate)
Error/alarms monitoring and injection	Per port FlexE PHY, per FlexE group and per client

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