# Digital Fault Recorder
# BLACKBOXDFR
## Don't be left in the dark


ELSPEC

# DFR

## Fully Featured Digital Fault Recorder

- Continuous Waveform Recordings
- Advanced Fault Location
- 1 µsecond Time Synchronization

# The Perfect DFR Solution

The BLACKBOXDFR is a fully-featured Digital Fault Recorder with continuous recording capabilities that make it possible to analyze short transient events, long term disturbances, as well as, trend input quantities.

- Multi function – DFR, Fault Locator, PQ Monitoring, PMU
- 24-Bit continuous acquisition at 1024 samples per cycle [50/60kHz
- Modular design with 16 analog and 96 digital channels per module
- Centralized or decentralized architecture
- Virtual Channels - More than 10000 parameters are continuously recorded for each analog channel
- Time synchronization accuracy of 1 µsecond

## PQZIP - Compression Technology

The unique patented PQZIP compression technology enables you to store up to 1000 times more information than typical file formats.

PQZIP allows storage of complete and precise data over extended periods of time.

# Unique Features

## Continuous Waveform Recordings

Exclusive only to the BLACKBOX family, the DFR is able to record and store all electrical waveforms for more than a year (Voltage and Current at 1024 samples per cycle). The BLACKBOXDFR's pioneering measurement method yields a superior accuracy by utilizing a 24-Bit A/D converter, thereby capturing the finest power quality details and deviations for 10000 electrical parameters.

## Software-Free Solution

The continuous recordings of the BLACKBOXDFR is saved on the device's local database. Based on the BLACKBOX's exclusive sampling rate, data may be accessed and analyzed directly either via the device's touch screen or any web browser at a resolution from ½ cycle up to 2 hours.

## Time Synchronization

A unique time synchronization algorithm assures that logged data from all the fault recorders located at different locations, is synchronized and displayed on the same time scale with typical 1 µsecond resolution. The time synchronization accuracy is further assured by the use of additional components, such as a GPS or a SNTP server. Results: every event from all BLACKBOXDFR devices is accurately analyzed at the exact time interval for a precise root cause analysis.

## Accurate Fault-Location Algorithm

The BLACKBOXDFR is equipped with a one and two-terminal impedance-based fault-location algorithm, which takes into account the distributed parameter line model. The algorithm utilizes synchronized measurements of voltages and currents from either one or two ends of a line, and formulates fundamental frequency phasors of symmetrical components of the measured signals. The fault-location algorithm is also geared up to calculate the distance from any fault to the measurement terminal.

## Real-Time Monitoring Via Touch Screen Control

The system features a user friendly touch screen interface that is easy to operate. All functions and measured values are accessed from the main menu. Monitor and control all your analog and digital inputs including important computed values at a glance in real-time.

## Full IEC 61850 Substation-Protocol Support

The BLACKBOXDFR fully complies with the IEC 61850 standards for substation automation that ensures complete control over all the equipment and systems during the acquisition, transferal and storage of events and data.

# Extended Web Interface

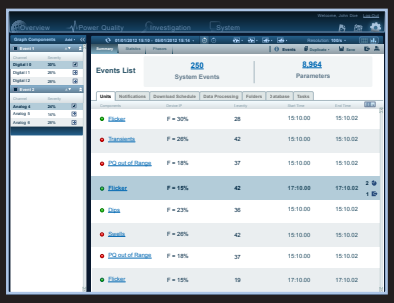
The BLACKBOXDFR is equipped with a fully featured web server using HTML5 web technology, enabling it to interface with any web-enabled device using most web browsers. Automatically access, process and transfer electrical data from any location via mobile smartphones, PDAs, IPads, tablets, or any other conventional PCs over a wide range of communication gateways.

## General Overview

The general overview of the BLACKBOXDFR, presents a full status of the measurements and system at a single glance. Divided into two sections, the left section contains measurements over each channel, RMS, THD values and RMS trends. Whereas the right section houses all the system information, system status and event listings.

## Investigation

From 10000 parameters recorded over 16 analog and 96 digital channels, zoom in on the finest power quality detail from 1 µsecond up to one year. Monitor the condition of the network system, detect instabilities earlier, effectively predict future failures with comprehensive information that is readily available. Analysis-made-easy with data that is displayed either by scopes, trends, statistics, summaries, spectrum graphs and more.



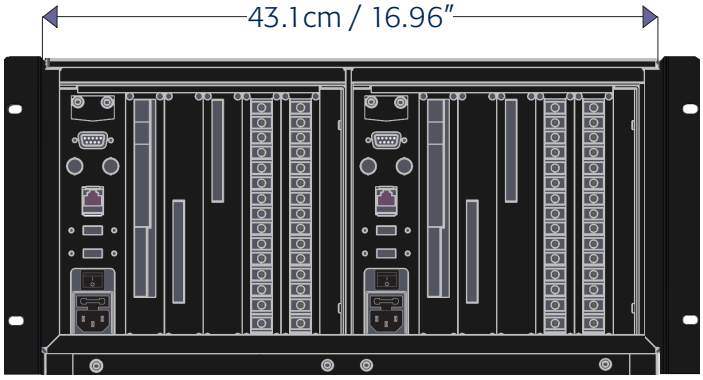
## Events

Effectively monitor a multitude of events including custom events, categorized either by Digital Input or by Power Quality events such as: dips; swells; transients etc. Enhanced system configurations makes it easy to configure any event based on any parameter(s) for any channel(s). The event platform makes data available either by category and or any combination of events, aggregated events and custom events.

# Unique Architecture

## Single / Double System Adaptability

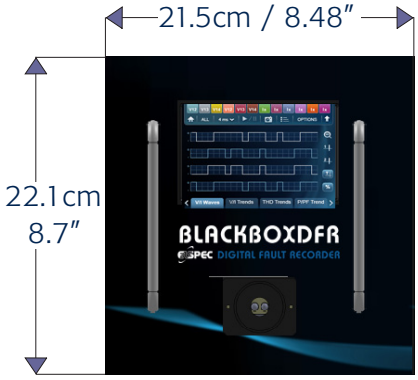

Front View



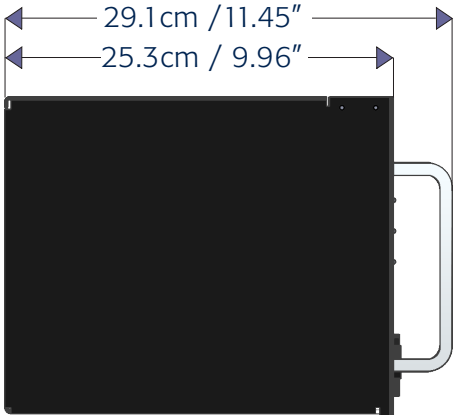

Rear View

The BLACKBOXDFR is housed in a metal cased enclosure, that may be mounted either on a 48.3cm (19″) / 24.1cm (9.5″) rack. The system architecture can be uniquely adapted either as a singular / double digital fault recorders.

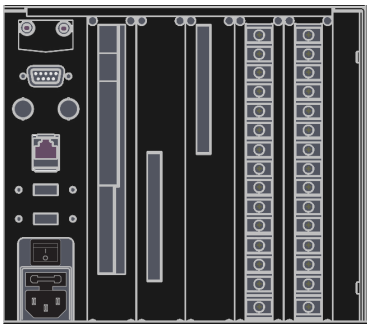
## Physical Dimensions




Front View




Side View



Rear View

| Measurements [W x H x D] Excluding Enclosure | | Measurements [W x H x D] Including Enclosure | |
|---|---|---|---|
| Single | 21.5 x 22.1 x 29.1 cm (8.48 x 8.7 x 11.45″) | Single | 24.1 x 22.1 x 29.1 cm (9.5 x 8.7 x 11.45″) |
| Double | 43.1 x 44.2 x 58.2 cm (16.96 x 17.4 x 22.9″) | Double | 45.7 x 44.2 x 58.2 cm (18 x 17.4 x 22.9″) |

## IEC 61000-4-30 Class A Test Reports

Upon request, Elspec can provide a comprehensive functionality and calibration test report for each fault recorder. Fully automated calibration software is also available for customers in-house use.

# Specifications

## General

| | |
|---|---|
| Sampling Rate, Samples/Cycle | Analog Channels: 1024 Digital Channels: 128 |
| Accuracy | 0.1% Both Voltage and Current |
| Type of Analog to Digital Converter | 24 Bit |
| Internal Memory | 16 GB Per 16 Analog Channels |
| Time Resolution | 1 µsec |
| Time Synchronization between Devices | 30 nsec |
| Internal Clock | 20 ppm Excluding External Synchronization |

## Power Quality Analysis

| | |
|---|---|
| Transient Detection, Microseconds (50Hz/60Hz) | 19.5/16.3µs |

## Applicable Measurement Standards

EN50160, IEEE1159, IEEE519, IEC61000-4-15, IEC61000-4-7, IEC61000-4-30 Class A, IEC62053-22/23 Class 0.2

## Human Machine Interface

Built-in 5" 1MP color touch LCD access for configuration, control & monitoring of all channels. Additional comprehensive web server for local and remote real-time monitoring, historical data analysis and control

## Applicable Safety Standards

EN61010-1:2001 2nd Edition

## Applicable Environmental Standards

IEC60068-2-1, 2, 6, 11, 27, 30, 75

## Applicable EMC Standards

EN55011 Group 1 Class A, EN60439-1 (clauses 7.9.1, 7.9.3, 7.9.4, 7.10.3, 7.10.4), FCC Part 15 Subpart B Class A, IEC61000-3-3, EN61000-6-2, IEC60255

## Voltage

| | |
|---|---|
| Channels | Selectable 0/4/8/12/16 |
| Nominal Full Scale | 1000V |
| Maximum Peak Measurement | 8kV |
| Input Impedance | 50MΩ |
| Uncertainty | 0.1% of Nominal |

## Current

| | |
|---|---|
| Channels | Selectable 0/4/8/12/16 |
| Nominal Full Scale | 5A/1A |
| Maximum Peak Measurement | 100A |
| Burden | 0.0001VA@5A |
| Uncertainty | 0.1% of Nominal |

## Time

| | |
|---|---|
| Real Time Clock | 20ppm |
| Synchronization Device | Accuracy |
| GPS | 1µs |
| IRIG B | 1µs |

## Frequency

| | |
|---|---|
| Fundamental Frequency | 37 Hz to 72 Hz |
| Frequency Resolution | 1 mHz |
| Frequency Accuracy | ±1 mHz |

## Power Supply

| | |
|---|---|
| Operating Range | 100-240 VAC<br>50/60 Hz<br>120-370 VDC<br>20 W |

## Environmental Conditions

| | |
|---|---|
| Operation Temperature | -20°C to 70°C(-4°F to 158°F) |
| Storage Temperature | -40°C to 85°C(-40°F to 185°F) |

## Communication Protocol

IEC 61850

**Disclaimer: Specifications subject to change without prior notice.**

## Worldwide Innovator in Power Quality

Since 1988 Elspec has developed, manufactured and marketed proven power quality solutions far exceeding our clients' needs and expectations. Our innovations not only simplify the understanding of the quality of power itself, but are also highly compatible, making it suitable for any business and or application. Elspec's international team of professionals with extensive experience in electrical engineering are ready to provide a tailor-made strategy that will enable a sustainable and efficient use of your electrical energy.


# International

**ELSPEC Ltd.**

**E-Mail:** info@elspec-ltd.com

# North America

**ELSPEC North America, Inc.**

**E-Mail:** info@elspecna.com

# Europe

**ELSPEC Portugal Lda.**

**E-Mail:** info@elspecportugal.com

# India

**ELSPEC Engineering India Pvt Ltd**

**E-Mail:** info@elspec.in


ELSPEC BLACKBOX

For All Products and Applications Visit

**Elspec At: www.elspec-ltd.com**



SMX-0227-0100 V1