

# BFM-II DFR

## Multi-Feeder Power Monitor & Digital Fault Recorder for Utility Substations



### SATEC BFM-II Series

Distribution substations constructed decades ago were equipped with electro mechanical protective relays for system protection. These relays have been in service for many years and regarded to be highly reliable with many years of operation remaining before they will need to be replaced. These devices however lack the functionality to provide performance and operational data essential to operate in a digital smart grid environment.

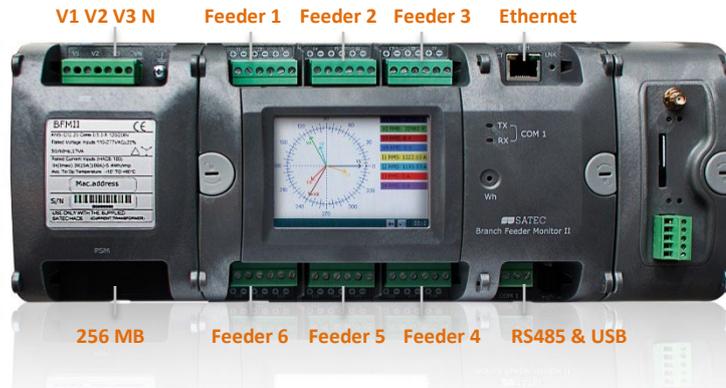
Utilizing a unique modular design the BFM-II Multi Feeder Monitor provides a cost effective alternative to enable utilities to update and upgrade their existing fleet of legacy substations directly contributing to an effective life extension strategy that delivers the required analog to digital transition with cutting edge automation technology. With the ability to facilitate installation that requires no outage, configurable feeder sizing and extensive I/O the advantages can be immediately realized.

### Advanced Unique Features



- ➔ Monitor 6, 8 or up to 12 three phase feeders in a single device
- ➔ Three phase multi feeder power monitoring including V, I, W, VA, Var, PF, Freq, Thd and more
- ➔ Power Quality monitoring of Voltage and Current Harmonics
- ➔ Digital Fault Recording with pre / post fault waveform capture
- ➔ Accuracy compliance to ANSI C12.20 0.2% / IEC 62053-22
- ➔ Internal data storage
- ➔ Multiple communications ports: RS485, Ethernet, USB (wireless modem option)
- ➔ Communications protocols: DNP 3.0, Modbus, BACnet
- ➔ Integrated LCD graphical touch screen display (with available remote display option)
- ➔ DIN rail or enclosure installation
- ➔ Universal Aux Power Supply for AC/DC operation 50-290VAC or 40-290VDC

## BFM II DFR Series Multi-Feeder Monitor



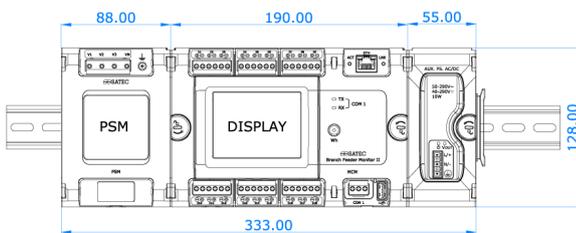
**AUX PS**  
**AC/DC Input**  
**50-290 VAC**  
**40-290 VDC**

\* Six feeder configuration shown

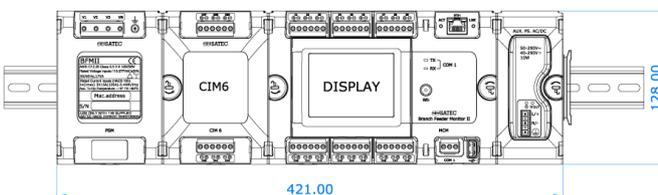
**256 MB**      **Feeder 6** **Feeder 5** **Feeder 4**      **RS485 & USB**

The BFM-II-DFR Series is a precise digital instrument for measuring multiple parameters of 3-phase electrical power systems. True RMS measurements via advanced digital signal processing ensure accurate data of hundreds of parameters on each load. Per phase as well as total measurements are provided for most parameters.

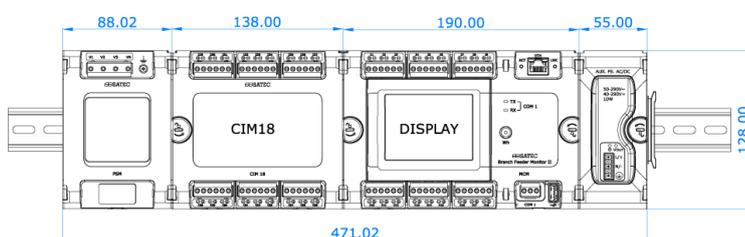
This device connects to the existing CT's and PT's to give total automation information, while co-existing with the existing electromechanical relays, and does not interfere with the protection scheme. The installation time is reduced dramatically where the entire substation can be updated in a single day. It extends the useful life of these relays by providing all the information that they cannot. The result is the most cost effective, fast means to automate and provide the full picture of operation never before provided by a single device:



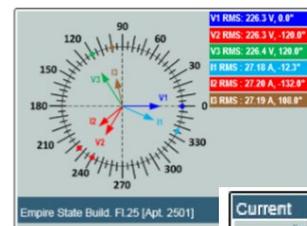
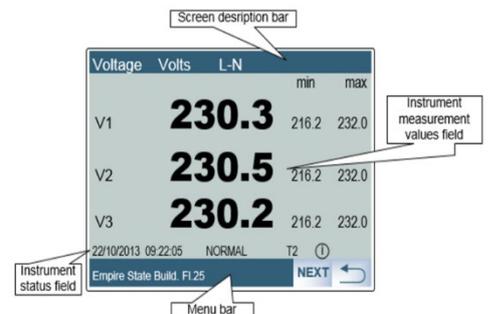
**BFM-II-ACDC-6F**



**BFM-II-ACDC-8F**



**BFM-II-ACDC-12F**

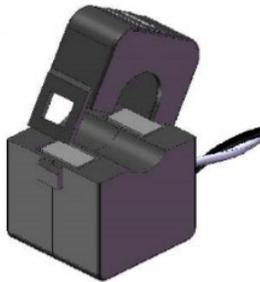


Current	Amps	min/max	Sign
11	199.3	0.1 200.0	110 199.3
12	199.3	0.1 200.0	111 199.3
13	199.3	0.1 200.0	112 199.3
14	199.3	0.1 200.0	113 199.3
15	199.3	0.1 200.0	114 199.3
16	199.3	0.1 200.0	115 199.3

## Available Options

### Clamp-On Installation

- ➔ Reduces Installation time
- ➔ Non – Intrusive to protection relays
- ➔ Up to 20x5A (100A) max
- ➔ Ultra low burden
- ➔ High degree of accuracy and reliability



CS1S (split)  
100A Current Sensor  
Opening 0.63"



Clip on existing 5A circuit  
Can be located up to 900 feet from meter base

### Remote Graphical Display

- ➔ 5.7" Touch Color Display
- ➔ View each circuit at a time
- ➔ Ethernet or serial interface
- ➔ Programable screen saver



Remote Front Panel  
Display  
RGM-180 (optional)



## Add-On Modules



### 18 DIGITAL INPUTS

- Optically isolated input, dry contact sensing (voltage-free)
- Internal power supply 5V DC
- Sensitivity:
  - Open @ input resistance >16kOhm, Closed @ input resistance <10kOhm
- Scan time: 1 cycle
- Withstand insulation: 4kV AC @ 1min
- Wire: 28-16 AWG (0.1-1.5 mm<sup>2</sup>), 600V isolation
- Terminal pitch: 3.81mm

### RELAY OUTPUTS

- 9 relays - SPST Form A
- Contact rating:
  - 5A @ 250V AC, 5A @ 30V DC
- Update time: 1 cycle
- Recommended Wire Size:
  - 18 AWG (1 mm<sup>2</sup>), 600V isolation
- Terminal pitch: 3.81 mm

### 4 ANALOG INPUTS

- Ranges (upon order):
  - ±1 mA (100% overload)
  - 0-20 mA
  - 4-20 mA
  - 0-1 mA (100% overload)
- Accuracy: 0.5% FS
- Scan time: 2 cycles
- Withstand Insulation: 4kV AC @ 1min
- Wire: 28-16 AWG (0.1-1.5 mm<sup>2</sup>), 600V isolation
- Terminal pitch: 3.81mm

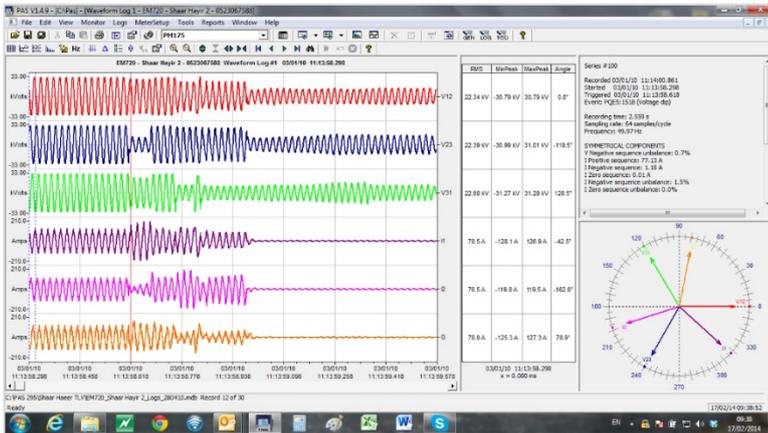
### CELLULAR COMMUNICATION

- Cellular Modem
- Technologies (upon order):
  - GSM
  - CMA
- Withstand Insulation: 4kV AC @ 1min
- Connector type: SMA
- Supported Protocols: MODBUS TCP (Port 502), DNP 3.0/TCP (Port 20000)

**NOTE:** Max. 2 modules

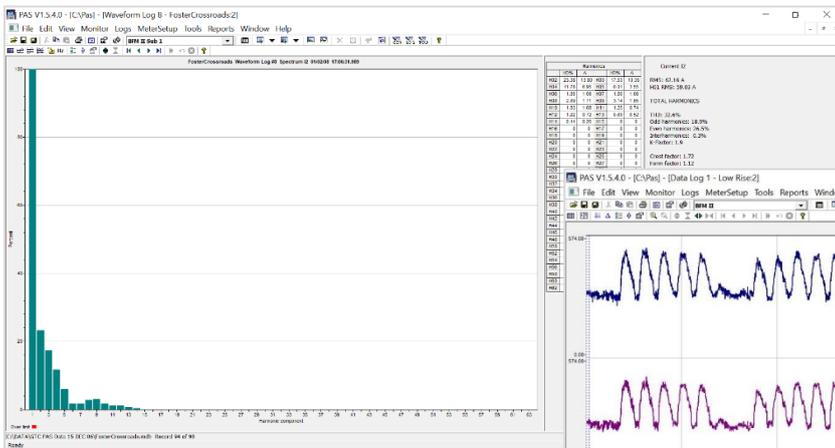
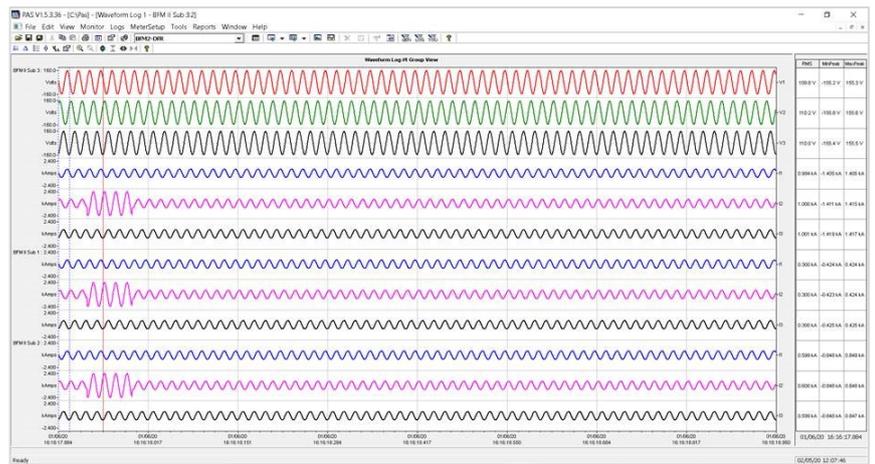
## Power Analysis Software (PAS)

Designed to both configure and monitor real time data and is bundled with all SATEC devices at no charge.



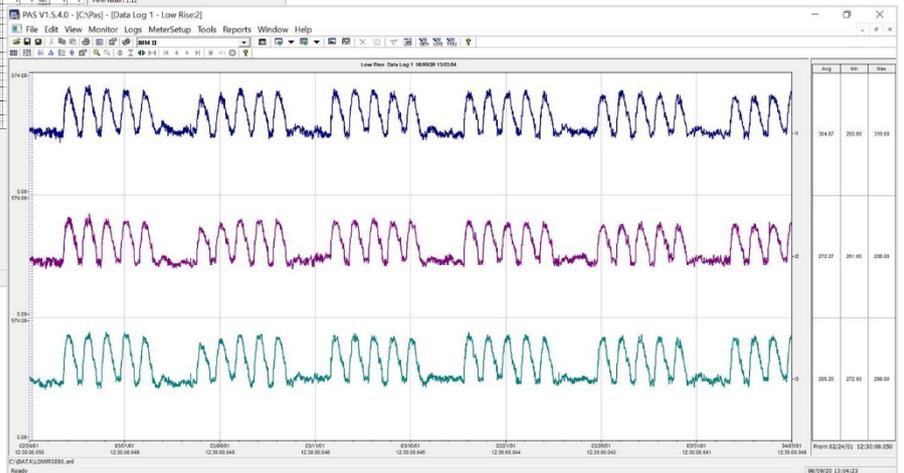
View event records and waveform capture  
Export to Comtrade format

Multi-Site view of up to 12 circuits



Detailed harmonic capture with direction

Log Trend screen



## Technical Specifications

### Environmental Conditions

Operating temp.	-30°C to +70°C (-22°F to 158°F)
Storage temperature	-40°C to +85°C (-40°F to 185°F)
Humidity	0 to 95% non-condensing
Altitude	≤ 2000m

### Construction

#### OVERALL DIMENSIONS

Width	278 mm/10.94" (18 channels) 554 mm/21.81" (54 channels)
Height	128 mm/5.04"
Depth	72.5 mm/2.85"
Weight	1.6kg (36 channels)

#### MATERIALS

Enclosure & Panels	Polycarbonate
PCB	FR4 (UL94-V0)
Terminals	PBT (UL94-V0)
Plug-in connectors	Polyamide PA6.6 (UL94-V0)
Packaging case	Carton and Stratocell (Polyethylene Foam) Brackets
Labels	Polyester film (UL94-V0)

### Power Supply

Withstand Insulation: 4kV AC @ 1min

#### 3 PHASE POWER SUPPLY (1, 2 OR 3 PHASE OPERATION) 3 X120/208 – 277/480 VAC

Input range	50-290 VAC / 40-290 VDC 50/60 Hz
Max. Power	10W
Burden for 277V	< 17 VA
Wire Size	up to 10 AWG (up to 6 mm <sup>2</sup> )
Terminal pitch	10 mm, 4 pins and Signal Ground stud

### Input Ratings

#### AC VOLTAGE INPUTS: V1, V2, V3, VN

Measuring range	3 x 120/208 – 277/480 VAC
Impedance Input	10MΩ
Burden for 277V	≈ 0.08 VA
Burden for 120V	≈ 0.02 VA
Galvanic Isolation, withstand insulation	4kV AC @ 1min
Connector Type	Removable, 4 terminals
Wire Size	Up to 10 AWG (up to 6 mm <sup>2</sup> )
Terminal pitch	10 mm

### AC CURRENT INPUTS

#### Standard: I1 – I36 – HACS

Input via SATEC HACS 100A to 3000A

Operating range	Maximum continuous 120% I max, i.e 120A for HACS 100A
Nominal measured Current	50A RMS (HACS 100A)
Burden	< 0.15 VA
Overload Withstand	100A RMS continuous
Connector Type	Removable, 6 terminals for 3 current inputs
Wire Size	10 AWG (2.5 to 6 mm <sup>2</sup> )
Terminal pitch	5 mm

#### Optional: I1 – I36 – RS5 Input via SATEC HACS CS05S

Operating range	Maximum continuous: 20A (Primary current)
Nominal measured Current	5A RMS (Primary current)
Burden	< 0.15 VA
Overload Withstand	12A RMS continuous
Connector Type	Removable, 6 terminals for 3 current inputs
Wire Size	10 AWG (2.5 to 6 mm <sup>2</sup> )
Terminal pitch	5 mm

### Plug-In I/O Modules

#### 18 DIGITAL INPUTS (UP TO 2 MODULES)

Optically isolated input, dry contact sensing (voltage-free)  
Internal power supply 5 VDC

Sensitivity	Open @ input resistance > 16kΩ, closed @ input resistance < 10kΩ
Scan time	½ cycle
Wire Size	12 AWG (up to 2.5 mm <sup>2</sup> )
Terminal pitch	3.81 mm

### Communication Ports

#### COM1 – STANDARD (MCM)

Serial EIA RS-485 optically isolated port	
Withstand Insulation	4kV AC @ 1 min
Connector Type	Removable, 3 terminals
Terminal pitch	5 mm
Wire Size	up to 12 AWG (up to 2.5 mm <sup>2</sup> ).
Baud Rate	up to 115,200 bps
Supported Protocols	MODBUS RTU/ASCII, DNP 3.0

#### COM3 – standard (MCM Display Communication port)

Serial TTL RS-232 non-isolated port for the GDM	
Baud Rate	up to 460,800 bps
Supported Protocols	MODBUS RTU

## USB Port – standard (MCM)

Isolated USB 1.1 port	
Withstand Insulation	4kV AC @ 1 min
Connector Type	A male, standard USB cable, max. Length 2 meters
Supported protocols	MODBUS RTU

## ETHERNET PORT – STANDARD (MCM)

Transformer-isolated	10/100Base-T port
Withstand Insulation	4kV AC @ 1 min
Connector Type	RJ45 modular
Supported Protocols	MODBUS TCP (Port 502), DNP3/TCP (port 20000), BACnet

Number of simultaneous connections (sockets): 5

SNTP – time synchronization

## Real-time Clock

Accuracy: better than 5 sec/month @ 25°C

## Memory Log

Standard onboard memory: 256 Mbytes

## Graphical Display Module – GDM (option)

3.5 Inch Touch-Panel LCD graphic TFT display	
Resolution	320 x 240
Operating temperature	-20°C - +70 °C
Communication	Serial TTL RS-232 non-isolated port

## Standards Specifications

### EMC per IEC 62052-11, IEC 62053-22, ANSI C12.1 and ANSI C12.20

- IEC61000-4-2: Electrostatic discharge, 15/- air/contact
- IEC61000-4-3: Electromagnetic RF Fields, 10V/m @ 80MHz – 1000MHz
- IEC61000-4-4: Fast Transients burst, 4KV on current and voltage circuits and 2 KV for auxiliary circuits
- IEC61000-4-5: Surge 6KV on current and voltage circuits and 1 KV for auxiliary circuits
- IEC61000-4-6: Conducted Radio-frequency, 10V @ 0.15MHz – 80MHz
- IEC61000-4-8: Power Frequency Magnetic Field
- IEC61000-4-12: Damped oscillatory waves, 2.5kV CM and 1kV DM
- ANSI C12.1 – 4.7.3.3.1: 100kHz Ring Wave surge, 6kV @ 0.5kA (per IEEE C62.41.2-2002)
- ANSI C12.1 – 4.7.3.3.2: line surge, 1.2/50µs – 8/20µs, 6kV @ 3kA (per IEEE C62.41.2-2002)
- ANSI C12.1 – 4.7.3.11: SWC 2.5kV (per IEEE 37.90.1)
- CISPR 22 – class B

### Insulation

- IEC 62052-11 (per NMI M6-1): Insulation impulse 12 kV/50Ω @ 1.2/50 µs
- IEC 62053-22: AC voltage tests related to ground, 4 kV AC @ 1mn, for power and signal ports (above 40V), or according to UL 61010-1/916 for basic and/or double insulation and Installation Category III

### Safety

- UL 916
- NMI M6-1

### Accuracy

- IEC/AZ 62053-22, class 0.5S
- ANSI C12.20-2010, Class 100, 400, accuracy 0.2%

### Atmospheric Environment

- Accuracy Operational ambient temperature range: – 25°C to +60 °C
- Operational ambient temperature range: –40°C to +70 °C
- Long-term damp heat withstand according to IEC 68-2-3 <95% (non-condensing), +40 °C
- Transport and storage temperature range: –40°C to +85 °C
- IEC 62052-11 (ref. IEC 60068-2-6): Vibration
  - Frequency range: 10Hz to 150Hz
  - Transition frequency: 60Hz
  - Constant movement amplitude 0.075mm, < 60Hz
  - Constant acceleration 9.8 m/s<sup>2</sup> (1g), f > 60Hz
- IEC 62052-11(ref. IEC 60068-2-27): Shock
  - Half sine pulse
  - Peak acceleration: 30gn (300 m/s<sup>2</sup>)
  - Additional Transport vibration and shocks:
    - Longitudinal acceleration: 2.0 g
    - Vertical acceleration: 1.2 g
    - Transversal acceleration: 1.2 g
- IEC 60529: IP50

## Available Configurations

BFM-II FEEDER MONITOR	
<b>6-Feeder Monitor</b>	
Monitors six 3-Phase Feeders on a common bus voltage via clip-on current sensors for 5 amp secondary circuits *	<b>BFM-II-DFR-ACDC-6F</b>
<b>8-Feeder Monitor</b>	
Monitors eight 3-Phase Feeders on a common bus voltage via clip-on current sensors for 5 amp secondary circuits *	<b>BFM-II-DFR-ACDC-8F</b>
<b>12-Feeder Monitor</b>	
Monitors twelve 3-Phase Feeders on a common bus voltage via clip-on current sensors for 5 amp secondary circuits *	<b>BFM-II-DFR-ACDC-12F</b>
<b>OPTIONS</b>	
<b>Frequency</b>	
50 Hz	<b>50HZ</b>
60 Hz	<b>60HZ</b>
<b>Current Sensors</b>	
100A Split Core Current Sensor Inner diameter 0.63 in, cable length 2.5 meters	<b>CS1S</b>
<b>OPTIONAL MODULES (ordered separately)</b>	
<b>DIGITAL INPUT/OUTPUT MODULES</b>	
18 Digital Input Module – DRY	<b>DI18-DRC-BFM II</b>
18 Digital Input Module - 24 VDC	<b>DI18-24V-BFM II</b>
18 Digital Input Module - 48 VDC	<b>DI18-48V-BFM II</b>
18 Digital Input Module - 125 VDC	<b>DI18-125V-BFM II</b>
18 Digital Input Module - 250 VDC	<b>DI18-250V-BFM II</b>
9 CH Relay Output Module - (Max 2 modules per device)	<b>RLY9-BFM II</b>
<b>ANALOG INPUT MODULES</b>	
4AI Module ± 1 mA - 4 Optically Isolated Analog inputs	<b>AI1-BFM II</b>
4AI Module 0-20 mA - 4 Optically Isolated Analog inputs	<b>AI2-BFM II</b>
4AI Module 0-1 mA - 4 Optically Isolated Analog inputs	<b>AI3-BFM II</b>
4AI Module 4-20 mA - 4 Optically Isolated Analog inputs	<b>AI4-BFM II</b>
<b>CIM Option (Up to 2 CIM's per Instrument)</b>	
CIM 6 - 6 CH Current Input Module	<b>C6H</b>
CIM 18 - 18 CH Current Input Module	<b>C18H</b>
<b>** OR FOR MEASURING WITH 5 Amp Secondary **</b>	
<b>IM Option (Up to 2 CIM's per Instrument) - RS5</b>	
CIM 6 - 6 CH Current Input Module	<b>C6-RS5</b>
CIM 18 - 18 CH Current Input Module	<b>C18-RS5</b>
<b>COMMUNICATION MODULES</b>	
None	<b>0</b>
4G GSM Modem plus 2nd RS-422/485 communication port	<b>T4G-BFM-II</b>
4G CDMA Modem plus 2nd RS-422/485 communication port	<b>T4C-BFM-II</b>

