



- Supports your targets of supplying high-quality power
- Enables preventive maintenance and shortened outage times
- Adds value to asset management
- Accurate fault location, condition monitoring
- Control, operational data and monitoring all available at a glance
- Flexible connectivity covers all your communications needs
- IEC 61850 support and simultaneous dual port communication



## Protection technology to support your goals

Based on proven technology, REF 541/543/545 Feeder Terminals provide you with a solution that supports both utility networks and industrial applications, including various network types and a variety of switchgear configurations. The REF feeder terminal supports your targets of supplying high-quality power and enabling efficient power system handling/management by providing suitable functions and comprehensive data exchange.

## One product – lots of opportunities

REF 541/543/545 Feeder Terminals bring many benefits in a single package. For example, the impedance based fault locator for short circuits and earth faults significantly shortens outage times by reducing field work and enhancing the accuracy of network control. Condition monitoring paves the way for preventive maintenance adding value to asset management. Measurement and control functions enhance network operation and management by, for example, providing comprehensive power quality data. The comprehensive protection functionality is available in standard configuration solutions. These can also be modified to meet specific requirements thanks to the unrivalled flexibility of the terminal.

## Cost-effective and comprehensive

REF 541/543/545 protection and control technology combines several functions in one unit. Control, operational data and monitoring are all available at a glance. Everything from process metrics to the condition of the power system equipment is fully covered. By integrating multiple functions into the same unit, you achieve cost effectiveness, high system reliability, safety and operability. Connectivity of REF 541/543/545 terminals to an up-level system is simplified considerably with the help of a connectivity package. Thus engineering times are reduced drastically.



## Innovative technology

The REF 541/543/545 Feeder Terminal is part of ABB's substation automation concept and the ABB RE500 series. Innovative solutions like IEC 61850 support and simultaneous dual port communication meet all your system requirements. The flexible connectivity caters for all your communications needs and helps to cover future demands. Their common configuration, setting and monitoring tools offer you yet another benefit: you only need to learn how to use one of our products, because all of our RE500-series protection relays and monitoring and control terminals use the same technology.

You can download the connectivity package from [www.abb.com/substationautomation](http://www.abb.com/substationautomation)

## Technical Data REF 541/543/545

Fault indication and protection functions	ANSI number
• 3I>, 3I>>, 3I>>>	50/51/51B
3-phase non-directional overcurrent, 3 stages	
• 3I>>>, 3I>>>>, 3I>>>>>	67
3-phase directional overcurrent, 3 stages	
• I <sub>0</sub> >, I <sub>0</sub> >>, I <sub>0</sub> >>>	50N/51N
Non-directional earth-fault, 3 stages	
• I <sub>0</sub> >>>, I <sub>0</sub> >>>>, I <sub>0</sub> >>>>>	67N
Directional earth-fault, 3 stages	
• U <sub>0</sub> >, U <sub>0</sub> >>, U <sub>0</sub> >>>	59N
Residual overvoltage, 3 stages	
• 3I>	49F
3-phase thermal overload (feeders & cables)	
• 3U>, 3U>>	59
3-phase overvoltage, 2 stages	
• 3U<, 3U<<	27
3-phase undervoltage, 2 stages	
• f<, f>, Δf/Δt	81U/81O
Under- or overfrequency incl. rate of change, 5 stages	
• O → I	79
Auto-reclosing	
• SYNC	25
Synchro-check/voltage check, 2 stages	
• 3I <sup>2</sup> f	68
3-phase inrush current detector	
• ΔI	46
Phase discontinuity	49M/49G/49T
• 3I	
3-phase thermal overload protection for devices	
• I <sub>S</sub> <sup>2</sup> t, n<	27/47/59
Start-up supervision for motors	
• U1<, U1>, U2>	
3-phase sequence voltage protection, 2 stages	

### CBFP Circuit breaker failure

- Capacitor bank protection
- 3-phase thermal overload protection
- Current unbalance protection
- Capacitor bank control
- Power factor controller

### Measurement functions

- 3I 3-phase current
- I<sub>0</sub> Neutral current
- 3U 3-phase voltage
- U<sub>0</sub> Residual voltage
- E/P/Q/pf 3-phase power and energy (incl. cos φ)
- f System frequency
- DREC Transient disturbance recorder - Measurement of RTD/analog inputs
- FLOC fault locator for short circuits and earth faults

### Power Quality Monitoring

- THD Current and voltage distortion measurements (1-13th harmonics)
- PQ3<sub>Inf</sub> Current waveform distortion measurement
- PQ3<sub>Unf</sub> Voltage waveform distortion measurement
- PQV3<sub>Sd</sub> Short duration voltage variation (sags and swells)

### Inputs/outputs

- Up to 34 digital inputs
- Up to 26 digital outputs incl. 2 outputs with trip circuit supervision
- 8 RTD/analog inputs (mA, U, ohm, Pt)
- time synchronization via binary input

### Energizing inputs

- 4 current transformers for 1 A and 5 A connection
- 1 current transformer for 0.2 A and 1 A connection
- 4 voltage transformers for 100 V-120 V connection
- 9 sensor inputs for current or voltage measurements

### Communication & Connectivity

- Protocols: LON<sup>®</sup>, SPA, Modbus<sup>®</sup>, DNP 3.0, PROFIBUS<sup>®</sup>, IEC 61850 (\*, IEC 60870-5-103 (\*))
- Connectivity package

### Condition monitoring

- Trip circuit supervision
- Fusefail
- Breaker wear
- Breaker travel time
- Breaker operational cycle counter
- Breaker inactive time
- Alarm for scheduled maintenance
- Spring charging time
- Measuring circuit supervision
- GAS pressure alarm
- Time indicator

(\* with interface adapter)

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