

# MiCOM P139

## Feeder Management and Bay Control



P139 in case 40TE

The MiCOM P139 is a cost effective one-box solution for integrated numerical time-overcurrent protection and bay control.

The broad spectrum of protection functions enables the user to cover a wide range of applications in the protection of cables and overhead lines, transformers and motors. In addition, numerous control functions are available. Thanks to the provision of four setting groups, the P139 device is readily adapted to varying conditions in system operation.

The control functions are designed for the control of up to six electrically operated switchgear units equipped with electrical check-back signaling located in the bay of a medium-voltage substation or a non-complex high-voltage station. For the selection of the bay type the P139 is provided with over 250 predefined bay types and allows download of customized bay type.

The intuitive user interface and the various communication interfaces allow easy control and monitoring of the switchgear units, simple and comprehensive setting as well as access to readings of extensive recordings. Numerous integrated communication protocols, including IEC 61850, provide interfacing to almost any kind of substation control or SCADA system. Furthermore the integrated InterMiCOM protection interface provides direct end-to-end communication between two protection devices.

The standard 19" modular case of the P139 with a user-selected number of plug-in modules provide a flexible solution for easy integration of the devices into the substation. The P139 is available for flush mounting as well as wall-surface mounting and provides the option of detachable HMI.



### CUSTOMER BENEFITS

- Protection and Control in one box
- Huge number of predefined bay types
- 1A/5A software setting
- Multiple communication protocols and interfaces, including IEC 61850
- Detachable HMI option

### APPLICATION

Overcurrent protection and control unit MiCOM P139 provides a wide range of protection and control functions.

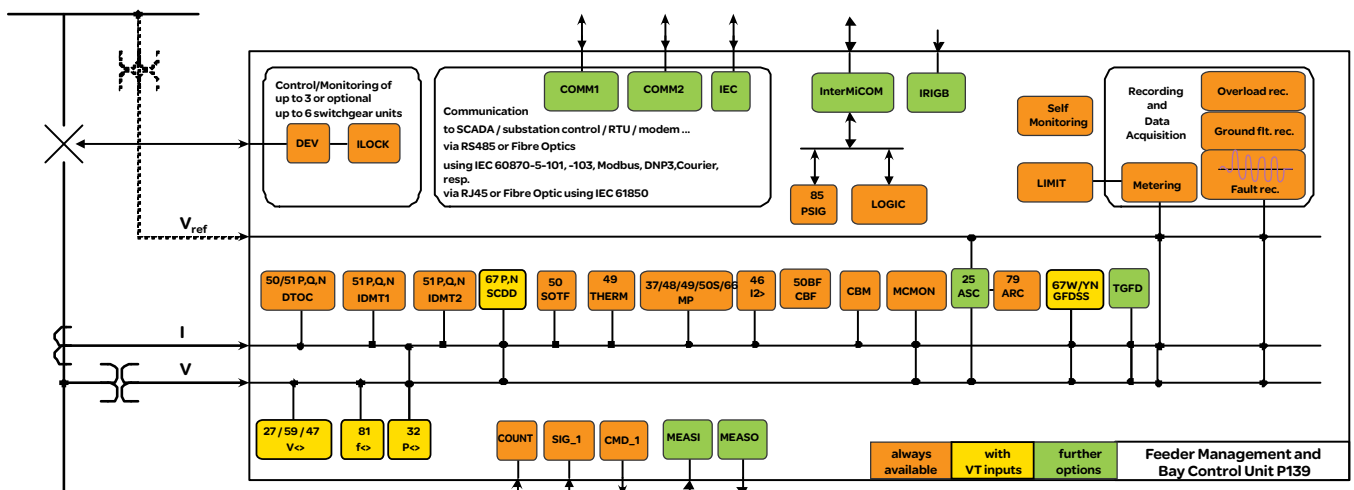
The scope of functionalities for P139 depends on the availability of CT and VT inputs fitted in the device.

Moreover, further options are provided for various protection and control requirements for example increasing the number switchgear units from 3 to 6 for control and monitoring and selection of automatic synchronism check.

PROTECTION FUNCTIONS OVERVIEW

Functions Overview			P139 with CTs	P139 with CTs /VTs
50/51 P, Q, N	DTOC	Definite-time o/c protection, three stages, phase-selective	•	•
51 P, Q, N	IDMT1	Inverse-time o/c protection, single-stage, phase-selective	•	•
51 P, Q, N	IDMT2	Inverse-time o/c protection, single-stage, phase-selective	•	•
67 P,N	SCDD	Short-circuit direction determination	-	•
50	SOTF	Switch onto fault protection	•	•
85	PSIG	Protective signaling	•	•
79	ARC	Auto-reclosure control (3-pole)	•	•
25	ASC	Automatic synchronism check	-	option
67W/YN	GFDSS	Ground fault direction determination	-	•
67N	TGFD	Transient ground fault direction determination	-	option
37/48/49/ 49LR/50S/66	MP	Motor protection	•	•
49	THERM	Thermal overload protection	•	•
46	I2>	Unbalance protection	•	•
27/59/47	V<>	Over-/Undervoltage protection	-	•
81	f<>	Over-/Underfrequency protection	-	•
32	P<>	Directional power protection	-	•
50BF	CBF	Circuit breaker failure protection	•	•
	CBM	Circuit breaker monitoring	•	•
	MCMON	Measuring circuit monitoring	•	•
	LIMIT	Limit value monitoring	•	•
	LOGIC	Programmable logic	•	•
	DEV	Control and monitoring of up to 3 resp up to 6 switchgear units	resp. option	resp. option
	CMD_1	Single-pole commands	•	•
	SIG_1	Single-pole signals	•	•
	ILOCK	Interlocking logic	•	•
	COUNT	Binary counter	•	•
	COMMx	2 comm. interfaces, protection comm. interface InterMiCOM	option	option
	IEC	IEC-61850-interface	option	option
	IRIGB	IRIG-B input	option	option
	INP / OUTP	Binary inputs / output relays (maximum number)	40 / 26	40 / 26
	MEASI/ MEASO	Analog I/O (2x 20 mA outputs, 20 mA input, RTD inputs)	option	option

Functional Overview (Description of ANSI code nos. see Function Overview)



## GLOBAL FUNCTIONS

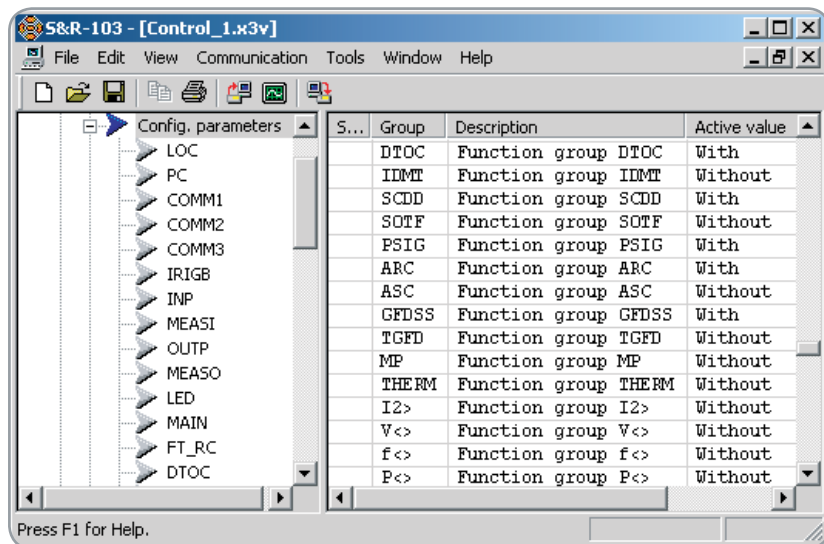
The following functions are generally available in all devices:

- Parameter subset selection (4 alternative setting groups)
- Metering
- Operating data recording
- Overload recording incl. overload data acquisition
- Ground fault recording incl. ground fault data acquisition
- Fault recording of all CT/VT inputs and binary events incl. fault measurands (e.g. fault location).

## MAIN FUNCTIONS

Main functions are autonomous function groups and can be individually configured or disabled to suit a particular application. Function groups that are not required and have been disabled by the user are masked completely (except for the configuration parameter) and functional support is withdrawn from such groups.

This concept permits an extensive scope of functions and universal application of the device in a single design version, while at the same time providing for a clear and straight-forward setting procedure and adaptation to the protection and control task under consideration.



Simple Function Selection by Mouseclick

## Time-Overcurrent Protection

For the overcurrent protection of the three phase currents, the residual current and the negativesequene current the P139 provides definite time overcurrent protection and inverse time overcurrent protection with a multitude of tripping characteristics.

The operate values of all overcurrent stages can be dynamically changed (e.g. under cold load pickup conditions). Additionally, some of the phase and negative-sequence current stages can be stabilized under inrush conditions if desired.

The residual and negative-sequence current stages affect the general starting signal. This effect can be suppressed if desired.

## Short-Circuit Direction Determination

Due to the short-circuit direction determination function, the P139 can be used as directional time-overcurrent protection device.

For the individual overcurrent stages the user can select whether the stage shall be forward-directional, backward-directional or non-directional. Direction determination is performed in separate measuring systems for the phase current and residual current elements, respectively.

## Switch On To Fault Protection

Closing of a circuit breaker might inadvertently lead to a short-circuit fault due to a maintenance ground clamp not yet removed, for example. The function 'switch on to fault protection' provides for an undelayed protective tripping during a settable time after a manual close command has been issued.



MiCOM P139 provides a wide range of protection and control functions

### Motor Protection

For the protection of directly switched h.v. induction motors with thermally critical rotor, the following specially matched protection functions are provided:

- Recognition of operating mode
- Rotor overload protection using a thermal motor replica
- Choice of reciprocally quadratic or logarithmic tripping characteristic
- Inclusion of heat dispersion processes in the rotor after several startups
- Separate cooling periods for rotating and stopped motors
- Startup repetition monitoring with reclosure blocking
- Control logic for heavy starting and protection of locked rotor
- Loss of load protection

Using the optional RTD inputs, direct monitoring of the temperatures of the stator windings and the bearings can be set up with the P139.

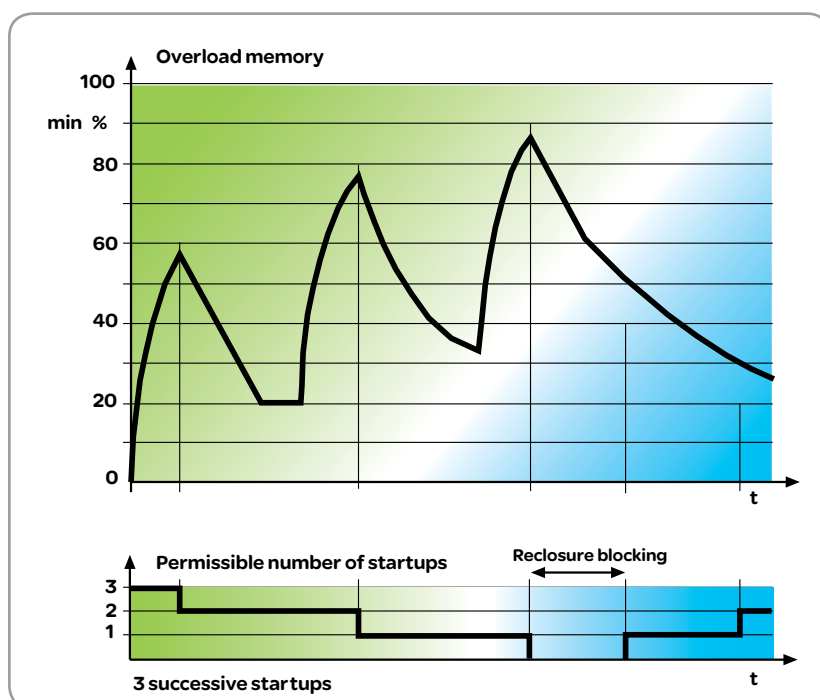
### Thermal Overload Protection

P139 provides thermal overload protection for lines, transformers and stator windings of h.v. motors. The highest of the three phase currents serves to track a first-order thermal replica according to IEC 255-8. The temperature of the cooling medium can be taken into account in the thermal replica using the optional RTD inputs or the optional 20 mA input.

The user has a choice of using a thermal replica on the basis of either relative or absolute temperature.

### Over-/Undervoltage Protection

The over- and undervoltage protection allows the multi-stage evaluation of directly measured and internally calculated voltages.



Overload memory and startup counter of motor protection

### Over-/Underfrequency Protection

The four-stage frequency protection can be operated as pure over- and underfrequency monitoring as well as combined with differential frequency gradient monitoring ( $df/dt$ ) for system decoupling applications or with medium frequency gradient monitoring ( $\Delta f/\Delta t$ ) for load shedding applications.

### Directional Power Protection

The directional power protection monitors the active and reactive power limits and detects power drop and reversal of direction.

### Ground-Fault Direction Determination

For the determination of the ground-fault direction in isolated or Peterson-coil compensated power systems two proven methods are provided:

- wattmetric or admittance method (analysis of steady-state signals)
- Transient method (analysis of transient signals) (optional).

### Circuit Breaker Monitoring

This function provides the user with several criteria for the assessment of circuit breaker wear:

- Calculated number of remaining operations based on the CB wear curve
- Mechanical operations count
- Interrupted currents sum (linear and squared)
- Accumulated current-time integrals of trips

For each of these criteria, a signaling threshold can be set by the user.

MiCOM P139

for rapid and selective fault clearance in your power system.



**Auto-Reclosing Control**

The auto-reclosing control (ARC) operates in three-phase mode. ARC cycles with one high speed reclosing (HSR) and multiple (up to nine) subsequent time-delay reclosings (TDR) may be configured by the user.

**Automatic Synchronism Check**

This option for the P139 can be used in conjunction with automatic or manual (re)closure and the close command of the control function. In non-radial networks this ensures that reclosure will proceed only if the synchronism conditions are met.

**Protective Signaling**

Protective signaling can be used in conjunction with short-circuit direction determination. For this purpose the protection devices must be suitably connected by pilot wires or the optional protection interface InterMiCOM on both ends of the line section to be protected.

For protection devices on the infeed side of radial networks, teleprotection can also be controlled without the short-circuit direction determination function.

**MEASURED DATA INPUTS AND OUTPUTS**

For the acquisition of an externally measured variable or the output of measured datas P139 provides optionally a 0 to 20 mA input and two 0 to 20 mA outputs. A settable scaling allows a simple adaption of the input resp. outputs ranges (e.g. 0 to 10 mA, 4 to 20 mA).

Up to 10 optional resistance temperature detectors are provided for direct temperature acquisition. Depending on the set operating mode, the RTD's operate in parallel or the RTD's can be subdivided into regular inputs and reserve inputs.

**PROTECTION INTERFACE InterMiCOM**

Optional InterMiCOM allows high performance permissive and blocking type unit protection to be configured, plus transfer of any digital status information between line ends. Intertripping is supported too, with channel health monitoring and cyclic redundancy checks (CRC) on the received data for maximum message security.

InterMiCOM provides eight end-to-end signal bits, assignable to any function within a MiCOM relay's programmable logic.

Default failsafe states can be set in case of channel outage.

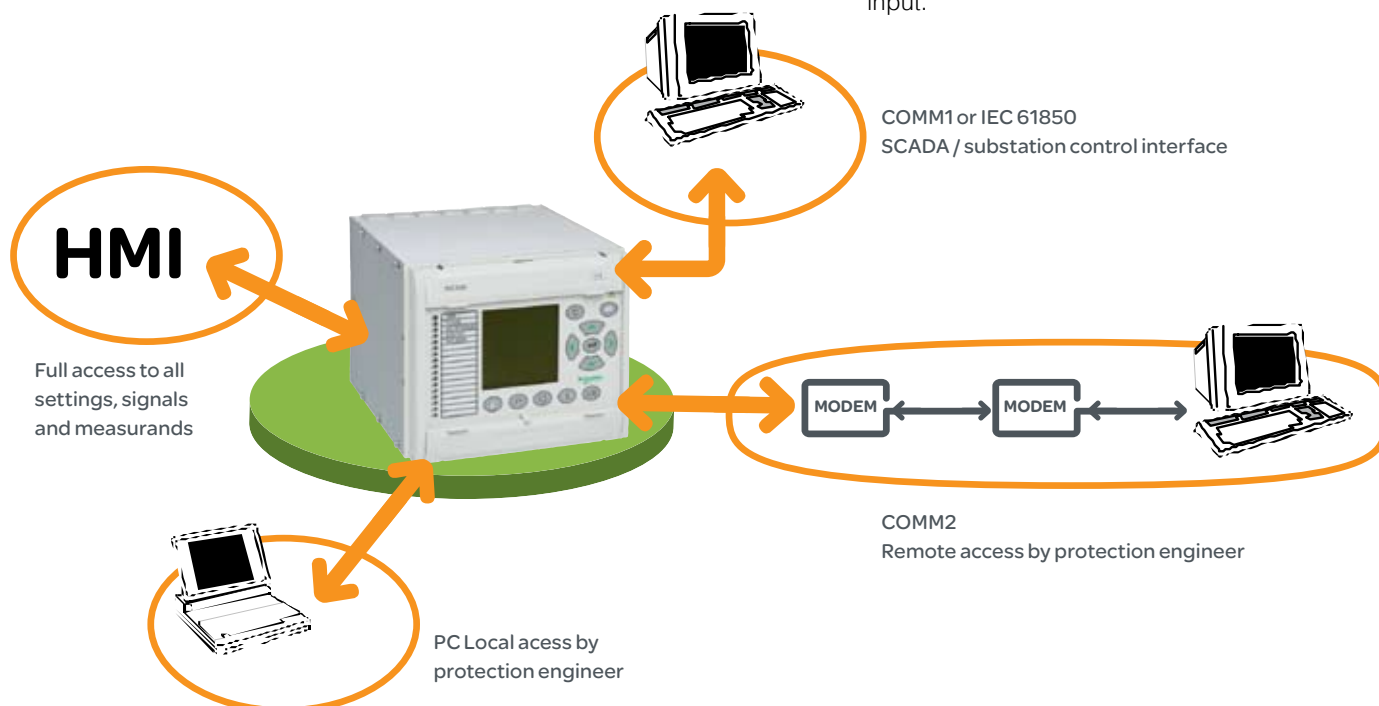
**INFORMATION INTERFACES**

Information exchange is done via the local control panel, the PC interface and two optional communication interfaces.

The first communication interface has settable protocols conforming to IEC 60870-5-103, IEC 60870-5-101, DNP 3.0, Modbus and Courier (COMM1) or provides alternatively protocol conforming to IEC 61850 (IEC) and is intended for integration with substation control systems.

The 2<sup>ND</sup> communication interface (COMM2) conforms to IEC 60870-5-103 and is intended for central settings or remote access.

Clock synchronization can be achieved using one of the protocols or using the IRIG-B signal input.



## CONTROL FUNCTIONS

The control functions are designed for the control of up to six electrically operated switchgear units equipped with electrical check-back signaling located in the bay of a medium-voltage substation or a non-complex high-voltage station.

External auxiliary devices are largely obviated through the integration of binary inputs and power outputs that are independent of auxiliary voltages, by the direct connection option for current and voltage transformers and by the comprehensive interlocking capability.

For the selection of the bay type the P139 is provided with over 250 predefined bay types. These include the assignment of binary inputs and outputs for the switchgear unit control and monitoring and the interlocking logic.

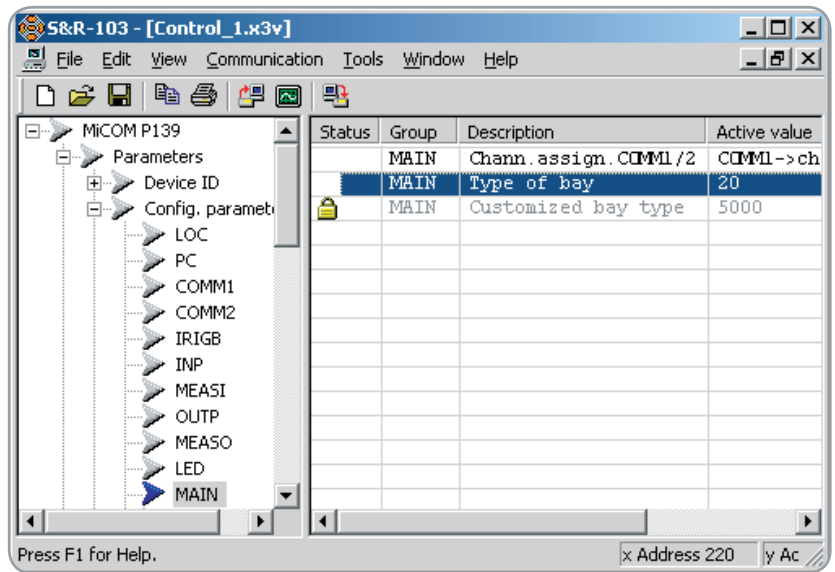
Additionally, a customized bay type can be created with bay type configurator BTC and downloaded in P139.

The P139 issues switching command outputs with the integration of switching readiness and permissibility tests; subsequently the P139 monitors the intermediate position times of the switchgear units. If a switchgear malfunction is detected, this fact will be indicated (e.g. by an appropriately configured LED indicator).

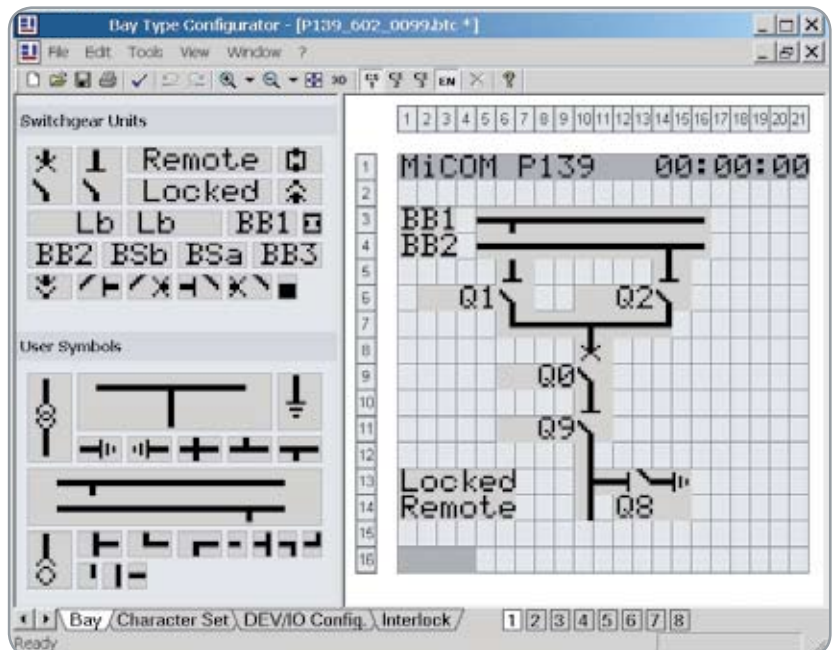
The acquisition of further binary inputs is in the form of single-pole operating signals; they are processed in accordance with their significance for the substation (circuit breaker readiness, for example). In addition to the switching command output, a triggering of binary outputs by single-pole commands is possible.

### Binary counter

For the acquisition of a binary count, a binary input may be configured. In the event of loss of operating voltage, the count is stored. Upon the following startup of the unit, counting is continued with the stored value as initial value.



Selection of bay type



Bay type creation with BTC



Proven control, advanced communication, complete local control, comfortable data handling.

### CONTROL AND DISPLAY

From the Local Control Panel all data required for operation of the protection and control unit are entered, the data important for system management are read out and the local control of switchgear units is executed.

With the help of the Display Panels, the user is able to carry out a quick and up-to-date check of the state of the bay.

On the Bay Panel the selected bay is displayed as a single-pole equivalent network (single line diagram) with the updated switchgear states. Moreover, ancillary information are displayed.

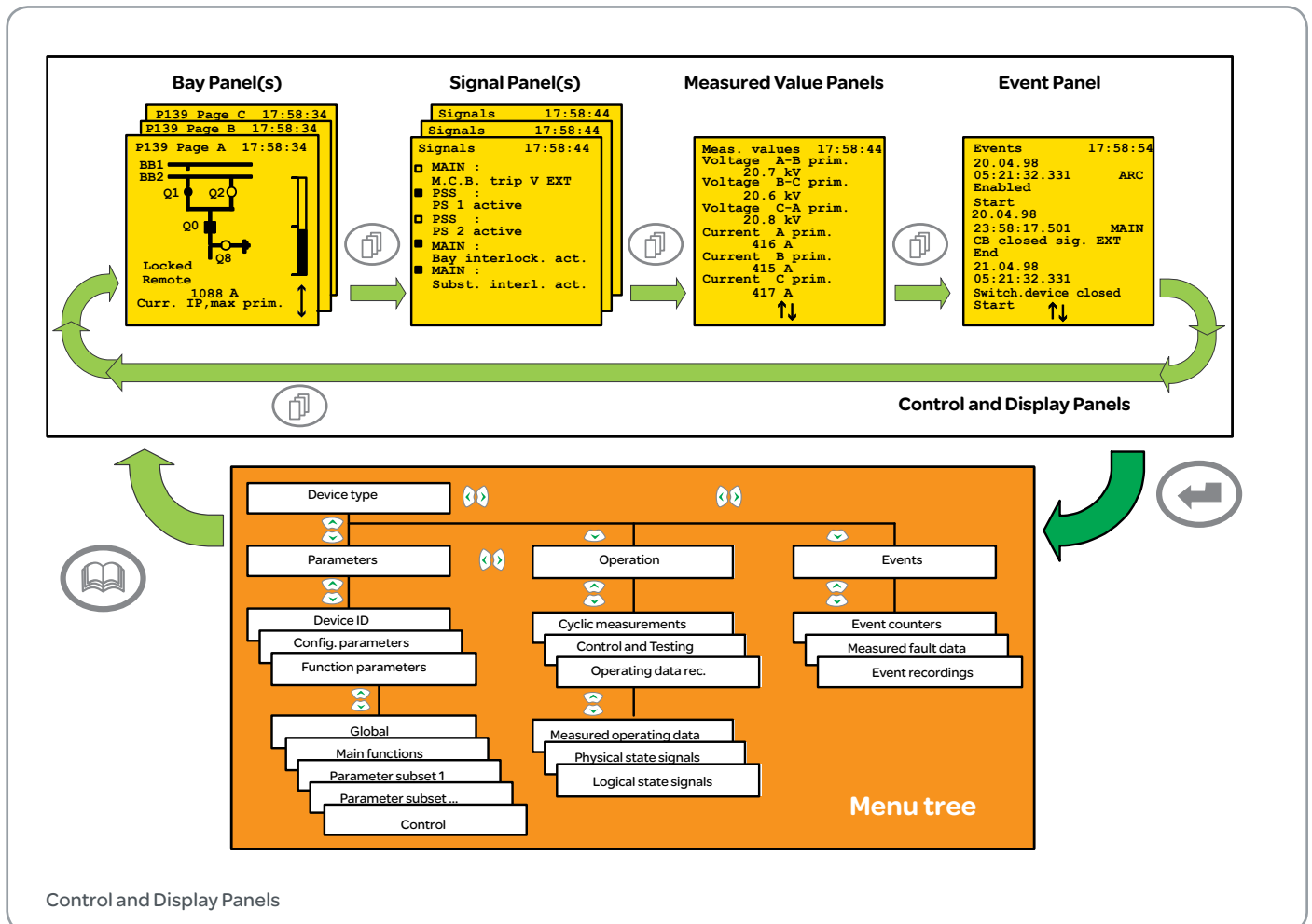
Up to 28 status signals are displayed on the Signal Panels which are activated automatically upon status changes. Moreover, presentation modes for the display of status data and status change information can be selected.

Selected measured values are displayed on the Measured Value Panels. The type of measured values shown (such as measured operating data or measured fault values) will depend on the prevailing conditions in the substation.



Detachable HMI Option

The Event Panel displays the most recent events with time-tagging such as the opening of a switchgear unit.



Control and Display Panels



## DEVICE TRACK RECORD

- **PS 982:** first one-box solution for integrated numerical time-overcurrent protection and control launched in 1998, more than 2,000 devices installed.
- **MiCOM P139:** Transformation of PS 982 into MiCOM P139 with extended functionality, more than 6,000 devices installed since 2001
- 2006: Implementation of **IEC 61850** interface and **detachable HMI**.

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