

# Grid Measurement, Protection and Synchronization

PLC integrated solutions for the energy supply.



# Modules for Grid Measurement

## Power Management

The widespread use of electricity in all aspects of work and life offers a multitude of benefits, greater convenience and an improved quality of life. In order to ensure energy-optimized solutions in production, in buildings and in infrastructures, there is a growing need for these to be based on suitable measuring systems. At the same time, the maintenance of supply security requires integrated solutions for operating grids and the standards compliant management of generating units. Bachmann electronic offers both synergies through the direct integration in the PLC world as well as certified compliance with the latest regulations.

The energy efficiency of machines and plants has significantly increased in importance. This requires devices for operational measurement at individual machines just as much as the overall total measurement of consumption at an entire site (energy monitoring).

At the same time, supply security must also be ensured at all network levels even when conditions are continually more difficult. So-called grid codes have been defined by grid operators

because of the mutual interaction that occurs between energy generating units and the electrical supply grid. These grid codes stipulate the required behavior of generating units and also major consumers in the event of different grid situations or faults.

Bachmann grid measuring modules accurately measure all relevant grid variables and provide the necessary monitoring/ protection functions in order to adhere precisely and simply to the specified grid codes.

Application areas	GM260	GMP232/x	GSP274
Operational measurement	✓	✓	✓
Energy monitoring	✓	✓	✓
Power quality	–	✓	✓
Monitoring / grid connection	–	✓	✓
Protection function	–	✓	✓
Online fault diagnostics	–	✓	✓
Generator connection (synchronization)	–	–	✓

The GSP274 module series also makes it possible to implement directly the actual synchronization of generating units with the supply grid. Implemented as standard modules in the modular M1 automation system, they enable the simple scaling and integration of other measured variables via signal or fieldbus interfaces. Several telecontrol protocols, OPC, email and FTP are provided for routing the data to higher-level systems. The standard configuration and diagnostics in the SolutionCenter engineering tool supports commissioning and teleservice tasks.



### GM260: GRID MEASUREMENT MODULE

- Compact design for 2 three-phase branches
- Measurement of current, voltage, frequency, power, power factor, phase angle
- 2 independent 4Q energy counters (active and reactive power, drawn/supplied)
- Accuracy V: 0.2%, I: 0.3%, P,Q: 0.5%
- TrueRMS calculation online
- Rated voltages up to 480 V directly connectable, 1A standard CT
- Cert.: CE, UL, DNV-GL, ABS, LR, BV



### GMP232/X: GRID MEASUREMENT AND PROTECTION MODULE

- Highly accurate measurement of current, voltage, frequency, power, power factor, phase angle
- Separate 4Q energy counters for TRMS and fundamental
- Rated voltages up to 690 V directly connectable, 1A/5A CTs
- Accuracy V: 0.1 %, I: 0.1 %, P,Q: 0.2 %, f: 1 mHz
- Measurement of grid harmonics up to the 50th as individual amplitudes, THD, TDD (power quality)
- Integrated real-time data recorder
- Integrated event logging
- Automated data aggregation (MEAN, MIN, MAX)
- Monitoring functions for grid and generator protection including:
  - Overshoot/undershoot of V, f
  - Rate of change of frequency
  - Maximum power, reverse power
  - Asymmetry, vector jump
  - Fault-Ride-Through (LVRT/FRT)
  - Voltage dependent reactive power protection (Q(U))
- Direct relay outputs for circuit-breaker/trip circuits
- Measured value simulation
- Cert.: CE, UL, BDEW (TR3, TR8), ENA ER G59/3, IEEE C37.90,...



### GSP274: GRID SYNCHRONIZATION AND PROTECTION MODULE

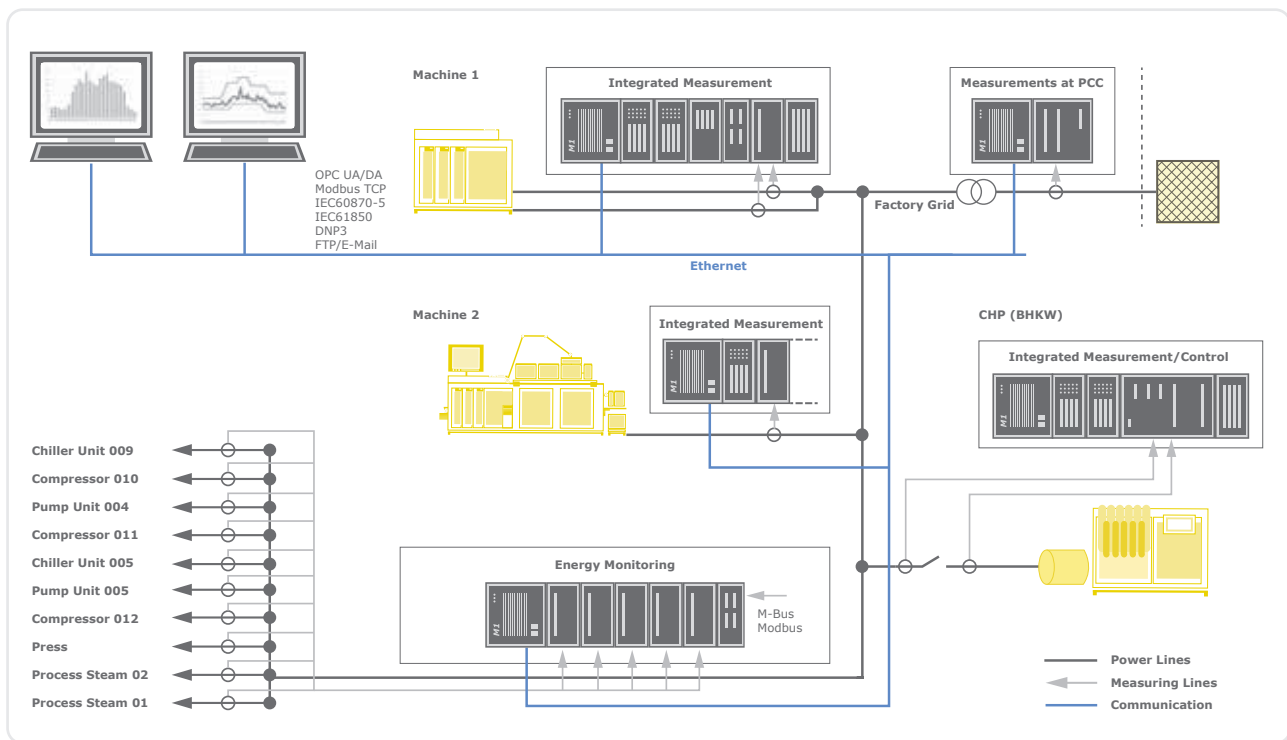
- Measurement of current, voltage, frequency, power, power factor, phase angle
- 4Q energy counter
- 7 voltage, 4 current inputs
- Synchronization monitoring
- Rated voltages up to 480 V directly connectable, 5A standard CTs
- Accuracy V: 0.1 %, I: 0.1 %
- Measurement of grid harmonics up to the 50th as individual amplitudes, THD, TDD (power quality)
- Integrated real-time data recorder
- Integrated event logging
- Monitoring functions for grid and generator protection including:
  - Overshoot/undershoot of V, I, f
  - Rate of change of frequency
  - Asymmetry, vector jump
  - Fault Ride Through (LVRT)
  - Voltage dependent reactive power protection (Q(U))
- 4 direct outputs for circuit-breakers/trip circuits and 2 relays for grid and system protection
- Measured value simulation
- Cert.: CE, UL, BDEW, VDE AR4105, G59/3, IEEE C37.90,...



## Plant integration with synergy

The energy modules of Bachmann electronic guarantee the reliable and fast measuring of all essential grid variables for a wide range of applications. From operational measurement directly in a production machine to the monitoring of entire distribution panels, right through to higher-level

power quality monitoring, system protection or the synchronization of generator plants. The I/O interfaces of the M1 system offer an ideal addition to the measuring units and communication protocols such as IEC 61850, IEC 60870, DNP3, OPC or Modbus are available for routing data to higher-level systems.



## Benefits

- High-performance data connection via backplane bus
- Minimum delay / high dynamics
- Cyclic request or network event-based updating (events)
- Correlation of various grid variables
- Correlation of various operating values
- Controller CPU permits additional calculations & combinatorics (based on provided calculation values or sampled data)
- Configuration management together with the M1 automation system
- Monitoring / data display via SolutionCenter, local visualizations (webMI) or SCADA
- Data transfer via telecontrol protocols and field buses
- Security and remote maintenance via M1 automation system

## Controller Integration

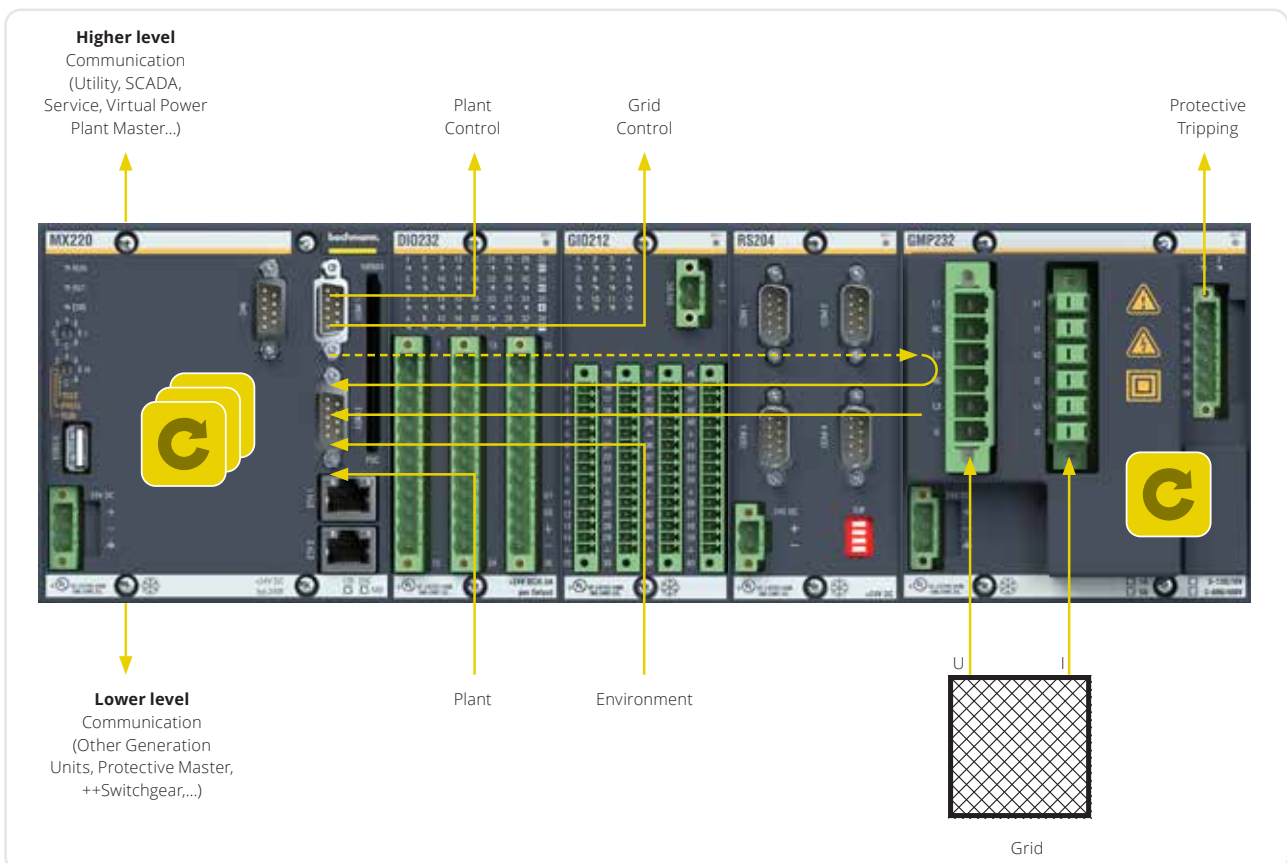
The grid measurement modules from Bachmann electronic are designed in compliance with the signal modules of the M1 system. When they are mounted on main or substations of the modular PLC system, the most important characteristic values of measured three-phase systems are already available as channel values.

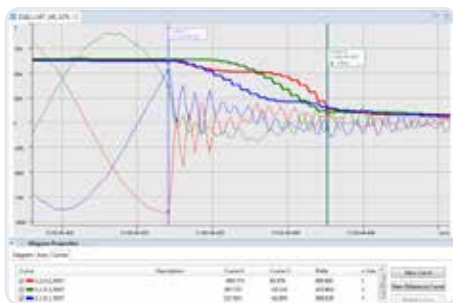
There is no need to configure communication elements or assign parameters for a fieldbus. Values recorded from a highly-dynamic process are available in the user program without any delay from asynchronous bus cycles. Especially time-critical or safety-critical functions, such as protective tripping in case of limit violations are processed by the modules completely autonomously. The grid module can also be mounted on an electrically iso-

lated substation and connected remotely to the PLC via fiber optic cables. Insights gained from measured values or the operational management status can be incorporated into the energy tasks at any time, and vice versa.

These correlations firstly allow the particularly low-stress operation of the plant, whilst also providing the basis for indirectly determining operating conditions and faults (for example, a change in power consumption in the particular operating state can indicate faults in the heating circuit).

No separate signal lines or tools are required for monitoring and remote maintenance. By being integrated in the security concept and privilege system of the controller, access to and data management of the grid modules are also regulated.





## Configuration & display

Grid modules from Bachmann electronic are fully integrated into the SolutionCenter. Configurations can be created efficiently and saved for reuse at a later time. An automated comparison of limit values set online with saved configuration files makes it easier to locate changes. Both the recorded channel values and the derived (calculated) variables are available at the user interface itself. Tabular, vectorial and time series displays facilitate development, commissioning and failure analysis.

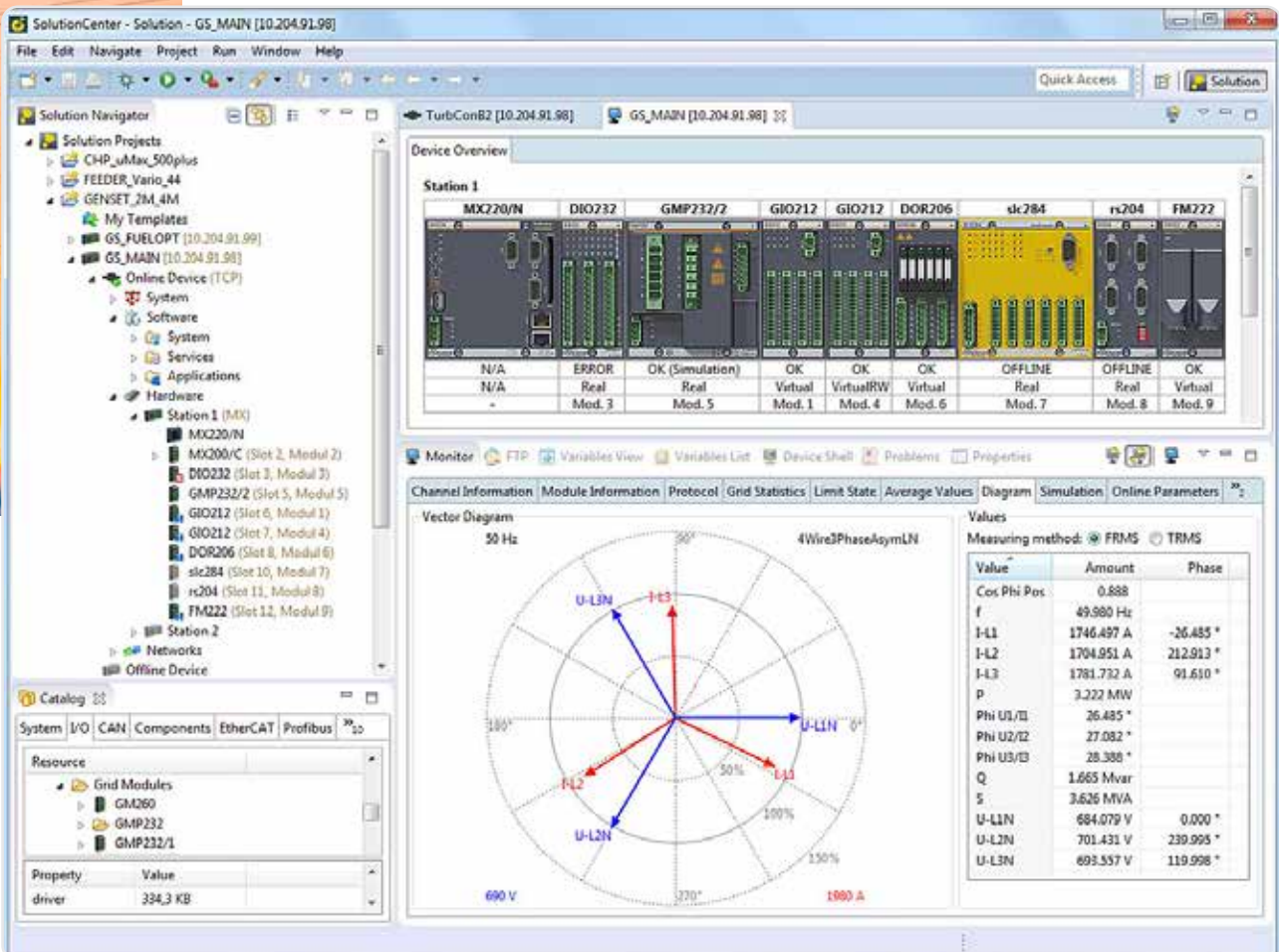
It is also possible to configure all measured and calculation values of the monitored three-phase supplies as well as graphic displays in a dynamic web interface (webMI).

The actual sequence of protection events (sequence of events) can be viewed in the event log of the pro-

tective devices. Thanks to globally-synchronizable time bases (SNTP, IEEE 1588 PTP), the event sequence can also be reconstructed from remote stations.

The modules of the GMP and GSP series offer a directly integrated high-performance data recorder. If a protection event occurs (or if activated in the PLC user program), high-resolution time series of selected grid values are also logged. The time leading up to the triggering event can also be logged using the pretrigger function. The data can be exported and transmitted in CSV or COMTRADE format (IEEE Std. C37.111).

Power quality values such as harmonic spectrum or various distortion factors can be displayed immediately in the SolutionCenter without the need for any programming, or read via the application program.



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