

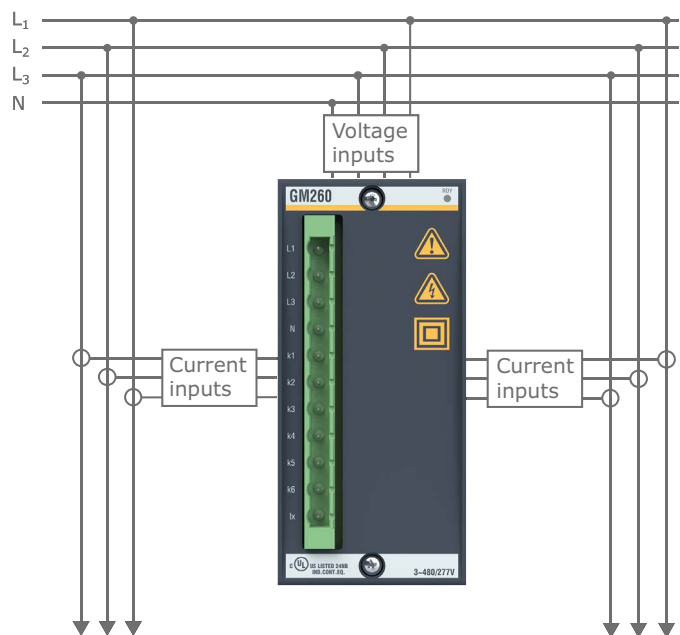
GM260 Grid Measurement Module

The GM260 module enables the safe, reliable and fast measuring of all relevant values for three-phase electrical networks. Two separate three-phase branches can be measured if there is a common voltage measuring point. The grid variables are calculated online in the module as True RMS values including harmonics up to the 40th harmonic. This is particularly useful for applications such as for operational measurement on machines or the energy monitoring in plants and buildings. As well as functions for determining the active, apparent and reactive power for each phase, two separate 4-quadrant energy counters are directly integrated in the module.

The GM260 module is fully integrated in the Bachmann SolutionCenter. Both the measured channel values and also the derived values are made available directly in the user interface.

| Item | Item-No. |
|----------|-------------|
| GM260 | 00022162-00 |
| GM260 CC | 00026118-00 |

- Measurement of current, voltage, frequency, power, power factor, phase angle
- Direct connection to input voltages up to 480 VL-L, RMS
- True RMS calculation online
- 2 independent 4Q energy counters
- Compact design for 2 three-phase branches



▼ Application example: Power measurement with common voltage input

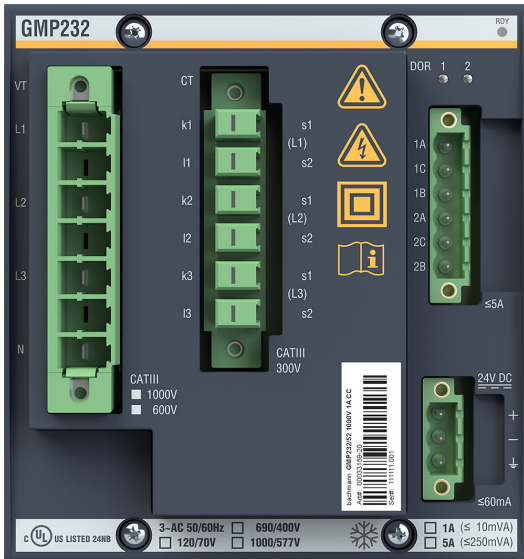
| GM260 – Grid Measurement | |
|--|---|
| Current/Voltage Measurement | |
| Measuring method | True RMS (incl. harmonics up to 40th) |
| Measurement interval | 50 Hz: 10 ms 60 Hz: 8.33 ms |
| Voltage Measurement | |
| Number | 3 |
| Maximum rated voltage | $U_{L-L, RMS}: 480 V_{rms}, U_{L-N, RMS}: 277 V_{rms}$ |
| Voltage measuring range | $U_{L-L, RMS}: 70 \text{ to } 625 V_{rms}, U_{L-N, RMS}: 36 \text{ to } 361 V_{rms}$ |
| Accuracy ¹⁾ | $\leq \pm 0.1 \%$ |
| Continuous overload | $U_{L-L, RMS}: 680 V_{rms}, U_{L-N, RMS}: 390 V_{rms}$ |
| Short-term overload(10x1 s, interval 10 s) | $U_{L-L, RMS}: 1039 V_{rms}, U_{L-N, RMS}: 600 V_{rms}$ |
| Input impedance | $>2 M\Omega$ |
| Current Measurement | |
| Number | 6 |
| Accuracy ¹⁾ | $\leq \pm 0.3 \%$ |
| Current transformer rated current | $1 A_{rms}$ |
| Current measuring range | $0.01 \text{ to } 1.2 A_{rms}$ |
| Current acquisition range | $0 - 1.2 A_{rms}$ |
| Continuous overload | $1.2 A_{rms}$ |
| Short-term overload (5x1 s, interval 300 s) | $20 A_{rms}$ |
| Apparent ohmic resistance | $75 mVA$ |
| Frequency Measurement | |
| Rated frequency | 50 / 60 Hz |
| Reference range | 45 to 65 Hz |
| Accuracy ¹⁾ | $\leq \pm 0,010 \text{ Hz (with average filtering down to } \leq \pm 0,005 \text{ Hz)}$ |
| Measurement interval | Updated at each positive zero crossing 50 Hz: 20 ms 60 Hz: 16.67 ms |
| Power Measurement – Active, Reactive and Apparent Power | |
| Measured values | P, Q, S per phase and as total |
| Accuracy ¹⁾ | $\leq \pm 0.4 \%$ |
| Calculation method | DIN 40110-2 |
| Measurement interval | Updated at each positive zero crossing 50 Hz: 20 ms 60 Hz: 16.67 ms |

1) Accuracy values as a percentage of the nominal value at 25 °C and reference conditions



| GM260 – Grid Measurement | |
|---------------------------------|--|
| Energy | |
| Number of energy counters | 2 |
| Accuracy* | ≤ ±0.4 % |
| Resolution | 1 Wh |
| Active energy | Supplied (positive), drawn (negative) |
| Reactive energy | Supplied (positive), drawn (negative) |
| Measurement interval | Updated at each positive zero crossing 50 Hz: 20 ms 60 Hz: 16.67 ms |
| Type of memory | Nonvolatile (on the module) |
| Memory cycle | 1 sec |
| Electrical Safety | |
| Product standard | IEC/EN 61131-2 |
| Generic standard | IEC/EN 60664-1 |
| Pollution degree | 2 |
| Overvoltage category | 3 |
| Test surge voltage | 4 kV |
| Protection class | 2 |
| Approvals / Certificates | |
| Maritime & Offshore | ABS, BV, DNV, LR, KR, NK, RINA |
| Ambient Conditions | |
| Operating temperature | -30 to +60 °C |
| Rel. air humidity, operation | 5 to 95 % no condensation |
| Storage temperature | -40 to +85 °C |
| Rel. air humidity, storage | 5 to 95 % with temporary condensation |
| Maximum operating height | 2,000 m above sea level (operation up to 4,500 m on request) |
| Power Supply | |
| Via backplane | +5 V ≤130 mA, +15 V ≤45 mA |
| System Requirements | |
| Hardware | All M1 CPU families apart from ME203, SK1 backplane not required |
| Software | M-Base 3.91 / SolutionCenter 1.91 or higher (recommended) (if the release driver is installed manually, also executable from the system software of the CPU ≥M-Base 3.90) |

| Order Codes | | |
|--------------------|-------------|--|
| Item | Item No. | Description |
| GM260 | 00022162-00 | Grid measurement module; 3x In 480V, 6x In 1A; U-, I-, P-, Q-, f-measurement; 4Q-energy metering |
| GM260 CC | 00026118-00 | Like GM260; ColdClimate (❄️) |
| Accessories | | |
| SS-GM260 B | 00023512-00 | Terminal set Phoenix screw side (1x SS 76/11) with labeling strip |



GMP232/x2 Grid measurement and protection module

The GMP232/x2 enables the safe, reliable and fast measurement of all relevant values for three-phase electrical networks. It also provides a number of monitoring functions for generator and grid protection. Up to 2 circuit-breakers/trip circuits are triggered by the module directly via relay outputs. The continuous monitoring of grid harmonics up to the 50th harmonic can be used for direct reactions as well as for evaluating the power quality.

The module is provided with an integrated real-time data recorder for the high-precision recording of up to 24 measuring channels during alarm/protection events. Error events are recorded continuously and stored with a high resolution time stamp. The internal time base of the module can be synchronized to an external time source (e.g. IEEE 1588 Precision Time Protocol), which supports the analysis of the data from geographically separated measurement and protection devices.

The GMP232/x2 module is fully integrated in the Bachmann SolutionCenter. Configurations can be created simply and stored for later reuse. Both the measured channel values and also the derived values are made available directly in the user interface. Commissioning and fault analysis are simplified with tabular, vector and time sequence displays. Event logs and recorded time sequences can be exported in CSV resp. COMTRADE format. The integrated simulation function simplifies the configuration of protection and monitoring functions.

Features

- Measurement of current, voltage, frequency, power, power factor, phase angle
- Direct connection up to 1000 V_{RMS} rated CAT III
- True RMS and fundamental RMS, symmetrical components
- High dynamic measurement / very low latency
- Measurement of grid harmonics up to the 50th (PQ)
- Configurable grid and generator protection
- Direct relay outputs for circuit-breaker/trip circuits
- Integrated real-time fault recording
- Integrated event logging
- 4Q energy meter
- Integrated mean value aggregation, grid statistics
- Measured value simulation

| Part type designation | | Part number |
|-----------------------|--------------|-------------|
| 120 V | | |
| 1 A | GMP232/12 | 00025962-20 |
| | GMP232/12 CC | 00025966-20 |
| 5 A | GMP232/32 | 00025964-20 |
| | GMP232/32 CC | 00025968-20 |
| 690 V | | |
| 1 A | GMP232/22 | 00025961-20 |
| | GMP232/22 CC | 00025965-20 |
| 5 A | GMP232/42 | 00025963-20 |
| | GMP232/42 CC | 00025967-20 |
| 1000 V | | |
| 1 A | GMP232/52 | 00033155-20 |
| | GMP232/52 CC | 00033159-20 |

| General | |
|------------------------------------|---|
| Range of application | Grid measurement, power quality monitoring, protection and fault recording in 3-phase-systems |
| System environment | Bachmann M1/M200 modular control system (plugable controller-integrated module) |
| Dimensions B × H × T ³⁾ | 110 mm × 119 mm × 68.5 mm |
| Weight ³⁾ | 495 g |

³⁾ unpacked without CPU, Backplane and other peripherals

GMP232/x2 – Grid measurement

| Acquisition | |
|------------------|--|
| Sampling rate | Grid frequency-dependent approx. 100 µs (10 kHz) |
| Update intervall | RMS and power values: continuous < 1 ms synced to cycle: 2-6 x per cycle |
| Sample values | Block access via application program (adjustable sampling 100 µs to 1600 µs) |
| Resolution | 16 bit on directly measured quantities |

| Voltage measurement | | | |
|---|---|---|--|
| Voltage inputs | 3 (L1, L2, L3, N) | | |
| Model variants | /12, /32 | /22, /42 | /52 |
| Rated voltage Y / Δ [V _{RMS}] | 70 V / 120 V | 400 V / 690 V | 577 V / 1000 V |
| Acquisition range Y / Δ [V _{RMS}] | 2 V to 196 V / 3.6 V bis 340 V | 10 V to 677 V / 17.3 V bis 1173 V | 13 V to 866 V / 22.5 V bis 1500 V |
| Continuous overload Δ [V _{RMS}] | 1100 V | 1100 V | 1660 V |
| Short-term overload 1 s Δ [V _{RMS}] | 2637 V | 2637 V | 3637 V |
| Overvoltage category acc. IEC 61010-1 | III for ≤ 600 V _{RMS} (L-N) IV for ≤ 300 V _{RMS} (L-N) | III for ≤ 600 V _{RMS} (L-N) IV for ≤ 300 V _{RMS} (L-N) | III for ≤ 1000 V _{RMS} IV for ≤ 600 V _{RMS} (L-N) |
| Accuracy voltage ¹⁾ | ≤ ±0.1 % U _{Rated} | ≤ ±0.1 % U _{Rated} | ≤ ±0.1 % U _{Rated} |
| Input impedance | > 3.2 MΩ | > 3.2 MΩ | > 5 MΩ |
| Input type | Differential (artificial Y) | | |

¹⁾ Accuracy at 25 °C and under reference conditions

| Current measurement | | | |
|---|--|-----------------------------|-----------------------------|
| Current inputs | 3 (I1, I2, I3 - I _N calculated) | | |
| Model variants | /12, /22 | /32, /42 | /52 |
| Rated current of tranformer [A _{RMS}] | 1 A | 5 A | 1 A |
| Response threshold [A _{RMS}] | 2 mA | 9 mA | 2 mA |
| Acquisition range [A _{RMS}] | 0.0025 A to 5 A | 0.013 A to 25 A | 0.0025 A to 5 A |
| Continuous overload [A _{RMS}] | 7 A | 20 A | 7 A |
| Short-term overload 1 s [A _{RMS}] | 100 A | | |
| Rated peak withstand current 0.25 s [A _{RMS}] | 250 A | | |
| Accuracy current ¹⁾ | ≤ ±0.1 % I _{Rated} | ≤ ±0.1 % I _{Rated} | ≤ ±0.1 % I _{Rated} |
| Burden | 10 mVA | 250 mVA | 10 mVA |
| Transformer compensation | Dynamic, current-dependent correction of amplitudes and phase response | | |

¹⁾ Accuracy at 25 °C and under reference conditions

| Frequency measurement | |
|-------------------------------------|--|
| Source | All 3 voltage phases, automatic reduction to any remaining phase in the valid measuring range. In the event of a 3-phase earth fault close to zero volt, the current signals are used. |
| Rated frequency | 50 Hz / 60 Hz |
| Acquisition range | 50 Hz: 10 Hz to 65 Hz, 60 Hz: 10 Hz to 75 Hz |
| Update intervall | T/12 (1.666 ms @ 50 Hz, 1.389 ms @ 60 Hz in 3 phase system) |
| Accuracy frequency ¹⁾ | $\leq \pm 1$ mHz |
| Frequency resolution | 0.1 mHz |
| Mean value calculation | f_avg: configurable arithmetic mean with sliding or sequential window |
| Event suppression | f2: configurable suppression of dynamic events (e.g. vector shifts) |
| Rate of change of frequency (df/dt) | Yes (configurable source and dynamics for ROCOF) |
| ROCOF range | ± 10 Hz/s |
| Reference system | Integrated frequency-constant reference system, calculation of the angle to the measured positive, negative and zero sequence system |
| Vector shift detection | $\geq 4^\circ$ with accuracy $\leq \pm 0.4^\circ$ |

¹⁾ Accuracy at 25 °C and under reference conditions

| Phase angle, sequence, asymmetry | |
|----------------------------------|---|
| Angles | Phase shift angles (PHI_UxIx) Voltage system angles (PHI_UxUy) Angles of voltage phasors to frequency constant reference system |
| Asymmetry U, I | Yes (ratio negative sequence/positive sequence for voltage and current phasors) |
| Phase sequence U, I | Yes |

| Power measurement | |
|---|---|
| Power quantities | P, Q, S, λ , $\cos\varphi$ (per phase and total); $\cos\varphi 1+$ |
| Power resolution (secondary) | 1 W, var, VA |
| Power calculations (simultaneously available) | DIN 40110-2 (incl. harmonics to 3 kHz) DIN 40110 (fundamental RMS values) IEC 61400-21 (fundamental symmetrical components) |
| Power accuracy ¹⁾ | $\leq \pm 0.2$ % von S_{Rated} |
| Power factor convention | 6 configurable calculation conventions |
| Energy meter | 2 separate 4Q meters for True RMS and fundamental power (non-volatile) |
| Energy resolution (secondary) | 1 Ws, vars |

¹⁾ Accuracy at 25 °C and under reference conditions

| Power quality | |
|-----------------------|---|
| Harmonic analysis | Yes, amplitudes up to 50th harmonic per phase for U and I |
| Calculation method | IEC 61000-4-7 |
| Update intervall | 200 ms at rated frequency (10 cycles at 50 Hz, 12 cycles at 60 Hz) |
| Characteristic values | Total harmonic distortion (THD) and Total demand distortion (TDD) for current and voltage per phase, in relation to rated value or actual fundamental |

¹⁾ Accuracy at 25 °C and under reference conditions

GMP232/x2 – Signal output / Tripping

| Relay outputs | |
|-------------------------------------|---|
| Quantity / contact arrangement | 2x changeover / form C |
| Rated voltage [V _{RMS}] | 230 V AC, 48 V DC, 24 V DC (not mixed) |
| Rated current [A _{RMS}] | 5 A |
| Making capacity [A _{RMS}] | 30 A acc. EN 60255-1 and IEEE C37.90; 2000x |
| Switching time OOT ²⁾ | Make time: typical 8 ms Break time: typical 4 ms |
| Indication | 2x LED (orange) |

²⁾ OOT Output Operating Time (additional delay of the switching device)

GMP232/x2 – Protection functions

| Protection functions | | |
|---|----------------------------|--|
| Time independent over current (ANSI 50, 51) | 3-level | I>, I>>, I>>> |
| Time independent directional over current (ANSI 67) | 2-level | I _{dir} >, I _{dir} >> |
| Unbalanced load / asymmetry current (ANSI 46) | 2-level | Asym_I>, Asym_I>> |
| Time independent over/under voltage (ANSI 27/59) | 2x 4-level | U<, U<<, U<<<, U<<<<, U>, U>>, U>>>, U>>>> |
| Time dependent over/under voltage (VFRT) | 4 limit curves / 11 points | U(t)>, U(t)< |
| Time independent positive seq. under voltage (27Vd) | 1-level | U ₁₊ < |
| Time independent negative seq. over voltage (59Vi) | 1-level | U ₁₋ > |
| Time independent zero seq. over voltage (59V0) | 1-level | U ₁₀ > |
| Asymmetry voltage (ANSI 47) | 2-level | Asym_U>, Asym_U>> |
| Time independent over/under frequency (ANSI 81O, 81U) | 2x 3-level | f<, f<<, f<<<, f>, f>>, f>>> |
| Time dependent over/under frequency (FFRT) | 2 limit curves / 11 points | f(t)>, f(t)< |
| Rate of change of frequency (ANSI 81 R) | 1-level | df/dt > |
| Vector shift (ANSI 78) | 2-level | Delta_Phi_U>, Delta_Phi_U>> |
| Maximum power (ANSI 32) | 2-level | P >, P >> |
| Reverse power (ANSI 32R) | 2-level | P _{dir} >, P _{dir} >> |
| Under voltage / reactive power (Q(U)) | 2-level | Q(U)>, Q(U)>> |
| Harmonics individual U (PQM) | 1-level | U _n > n=2..50 |
| Harmonics individual I (PQM) | 1-level | I _n > n=2..50 |
| Harmonics total distortion U (PQM) | 1-level | THD_U>, THD _n _U> |
| Harmonics total distortion I (PQM) | 1-level | THD_I>, TDD_I> |
| Application specific tripping / manual | Programmable / yes | |

| Protection functions common | |
|-----------------------------|--|
| Input values | Configurable (fundamental, fundamental positive sequence, True RMS, 10-min mean sliding window acc. EN 50549; all / any phase) |
| Tripping delay | 0 ms to 600 000 ms (10 min) adjustable for time independent protection functions |
| Start blocking (inhibit) | From application program on M200 CPU e.g. operating condition or up-/downstream devices |
| Blocking | Configurable with criteria such as under/over voltage, under/over frequency, maximum negative sequence system |
| Tripping reactions | Trip relay 1 Trip relay 2 Trigger fault recording programmed reaction |
| Relay reset | Configurable time delayed auto reset or manually via application program or user input |

| Protection functions common | |
|-----------------------------|--|
| Autonomy | Acquisition, calculation and protective tripping run independently of the M200 CPU on module |
| Data preparation / storage | |
| Event recording | 2048 protective tripping events non-volatile ring buffer, absolute counter |
| Real time fault recording | 24 channels configurable, trigger from protective tripping or via application program, 100 μ s to 1600 μ s sampling time (6 s to 96 s recording as COMTRADE file IEEE Std. C37.111), pre-trigger |
| Grid statistics | Maximum/minimum of several grid quantities with time stamp (non-volatile), resettable |
| Data aggregation | 3 aggregation units available: 1+2: for 24 configurable channels, 2-staged 3: harmonics; automatic calculation of mean, minimum, maximum for configurable intervals from 0.2 s / 3 s to 15 min |

GMP232/x2 – Special functions

| Communication interfaces | |
|--------------------------|---|
| Time synchronization | IEEE 1588 Precision Time Protocol, SNTP via M200 CPU (for time stamps) |
| Fieldbuses | Profinet, Profibus, EtherCAT, CAN/CANopen via M200 CPU |
| RTU / telecontrol | IEC 61850, IEC 60870-5-4, -3, -1, DNP3, Modbus TCP/UDP/RTU/ASCII via M200 CPU |
| Supervisory control | OPC UA DA, AE, Methods server, OPC UA DA, Methods client, OPC COM via M200 CPU |
| Simulation | |
| Description | In the simulation mode, the module uses internally generated values instead of measured samples. All subsequent calculations and protection functions work exactly the same as in measurement mode. The setting of simulation parameters can be handled in the graphical user interface of the SolutionCenter (user) or dynamically from an application program on the M200 CPU (automated sequences). Thus, protection functions or general measurement reactions can be evaluated in many cases without using specialized grid emulation equipment. |
| Simulation input | 3x U_{RMS} [%pu], 3x I_{RMS} [%pu], 3x ϕ_U [°], 3x ϕ_I [°], f |

GMP232/x2 – Module properties

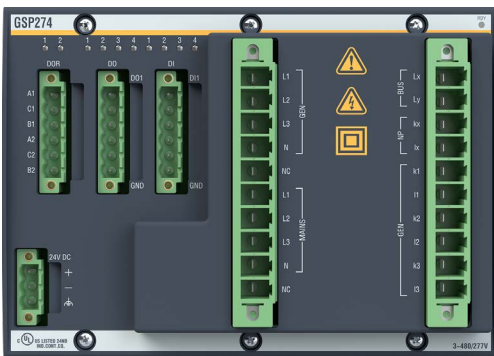
| Product safety | |
|---|--|
| Product standard / application standard | IEC/EN 61131-2 / EN 60255 / UL CSA EN IEC 61010-1, -2-101, -2-030 |
| Pollution degree acc. IEC 61010-1 | 2 |
| Overvoltage category acc. IEC 61010-1 | IV / III |
| Rated impulse voltage | /12, /22, /32, /42: 6 kV /52: 8 kV |
| Isolation serial production test | /12, /22, /32, /42: 4700 V DC /52: 6000 V DC |
| Protection class acc. IEC 61010-2-201 | 2 |
| Degree of protection acc. to IEC 60529 | IP20 |
| Self-monitoring | Integrated self-testing and run time measurement, watchdog function |
| Self-monitoring reaction | Configurable according BDEW and FNN; Logging: Module/CPU |
| Environmental conditions | |
| Operating temperature | -30 °C to +60 °C (+70 °C on request) |
| Relative humidity, operation | Standard: 5 % to 95 % noncondensing |
| | ColdClimate: 5 % to 95 % with temporary condensation |
| Storage temperature | -40 °C to +85 °C |
| Relative humidity, storage | 5 % to 95 % with temporary condensation |
| Installation altitude | 2000 m above sea level (up to 4500 m with over-voltage and temperature derating) |
| Energy supply | |
| Backplane | +5 V ≤ 250 mA, +15 V ≤ 20 mA, -15 V ≤ 17 mA |
| Front supply | +24 V ≤ 60 mA |
| Approvals/Certificates | |
| General product safety | CE, UKCA, cULus |
| Generator grid connection | VDE-AR-N 4110:2018, VDE-AR-N 4120:2018, FGW TR3 Rev 26, FGW TR8 Rev 9 IEEE Std. C37.90:2005, IEEE Std. C37.90.1:2012, IEEE Std. C37.90.2:2004, IEEE Std. C37.90.3:2001 EN 50549-2, ENA ER G99 Amendment 9:2022 |
| Maritim classifications | ABS, BV, DNV, LR, KR, NK, RINA |
| System requirements | |
| Automation system | Bachmann M200 system with CPU (except ME203), power supply and backplane (SK1 not required) |
| Required slots available | 2 slots |
| Software | M-Base ≥ 4.66 for full feature set (including SolutionCenter ≥ 2.66) |

Order data

| Part type designation | Part number | Description |
|-----------------------|-------------|--|
| GMP232/12 120V 1A | 00025962-20 | Grid measurement and monitoring module; 3x In 120V CAT IV, 3x In 1A; 2x Out relay 24/48V DC, 230V AC; U-, I-, P-, Q-, f-measurement; 4Q-energy metering, integrated monitoring/protection functions, harmonic analysis, integrated real-time data recorder (24 channels); data aggregation, sequence of event log with real-time stamp |
| GMP232/12 120V 1A CC | 00025966-20 | Like GMP232/12 120V 1A; ColdClimate (❄) |
| GMP232/22 690V 1A | 00025961-20 | Grid measurement and monitoring module; 3x In 690V CAT III, 3x In 1A; 2x Out relay 24/48V DC, 230V AC; U-, I-, P-, Q-, f-measurement; 4Q-energy metering, integrated monitoring/protection functions, harmonic analysis, integrated real-time data recorder (24 channels); data aggregation, sequence of event log with real-time stamp |
| GMP232/22 690V 1A CC | 00025965-20 | Like GMP232/22 690V 1A; ColdClimate (❄) |
| GMP232/32 120V 5A | 00025964-20 | Grid measurement and monitoring module; 3x In 120V CAT IV, 3x In 5A; 2x Out relay 24/48V DC, 230V AC; U-, I-, P-, Q-, f-measurement; 4Q-energy metering, integrated monitoring/protection functions, harmonic analysis, integrated real-time data recorder (24 channels); data aggregation, sequence of event log with real-time stamp |
| GMP232/32 120V 5A CC | 00025968-20 | Like GMP232/32 120V 5A; ColdClimate (❄) |
| GMP232/42 690V 5A | 00025963-20 | Grid measurement and monitoring module; 3x In 690V CAT III, 3x In 5A; 2x Out relay 24/48V DC, 230V AC; U-, I-, P-, Q-, f-measurement; 4Q-energy metering, integrated monitoring/protection functions, harmonic analysis, integrated real-time data recorder (24 channels); data aggregation, sequence of event log with real-time stamp |
| GMP232/42 690V 5A CC | 00025967-20 | Like GMP232/42 690V 5A; ColdClimate (❄) |
| GMP232/52 1000V 1A | 00033155-20 | Grid measurement and monitoring module; 3x In 1000V CAT III, 3x In 1A; 2x Out relay 24/48V DC, 230V AC; U-, I-, P-, Q-, f-measurement; 4Q-energy metering, integrated monitoring/protection functions, harmonic analysis, integrated real-time data recorder (24 channels); data aggregation, sequence of event log with real-time stamp |
| GMP232/52 1000V 1A CC | 00033159-20 | Like GMP232/52 1000V 1A; ColdClimate (❄) |

Accessories

| Part type designation | Part number | Description |
|-----------------------|-------------|--|
| SS-GMP232/x2 | 00037391-00 | Terminal set screw contact (1x SS 51/03; 1x SS 51/06; 1x SS 76/06 inv.; 1x SS 76/07 reduced pins) with labeling strips |
| SS-GMP232/x2 KZ | 00037392-00 | Terminal set screw / cage (1x KZ 51/03; 1x KZ 51/06; 1x SS 76/06 inv.; 1x SS 76/07 reduced pins) with labeling strips |



| Item | Item-No. |
|-----------|-------------|
| GSP274 | 00019756-00 |
| GSP274 CC | 00021759-00 |

GSP274 Grid Measurement, Synchronization and Protection Module

The GSP274 enables the safe, reliable and automatic synchronization of generator units to the power supply grid. It also provides a number of monitoring functions for generator and grid protection. The circuit-breakers are tripped by the module directly via digital outputs and relays. Additional digital inputs enable the monitoring of the relevant switching state. The continuous monitoring of grid harmonics up to the 50th harmonic can be used for direct responses as well as for evaluating the power quality.

The module is provided with an integrated real-time data recorder for the high-precision recording of up to 16 measuring channels during protective tripping or synchronization. Error events are recorded continuously and stored permanently with a high resolution time entry. The internal time base of the module can be synchronized to an external time source (e.g. IEEE 1588 Precision Time Protocol), which supports the analysis of the data from spatially separated measurement and protection devices.

The GSP274 is fully integrated in the Bachmann SolutionCenter. Configurations can be created simply and stored for later reuse. Both the measured channel values and also the derived values are made available directly in the user interface. Commissioning and fault analysis are simplified with tabular, phasor and time sequence displays. Event logs and recorded time sequences can be exported in CSV respectively COMTRADE format. The integrated simulation function simplifies the configuration of protection and monitoring functions.

- Measurement of current, voltage, frequency, power, power factor, phase angle
- Measurement of grid harmonics up to the 50th (power quality)
- Synchronization monitoring / Synchro-check
- Monitoring/Protection functions for grid and generator protection
- Controls two circuit-breakers
- Integrated real-time data recorder
- Integrated event logging
- 4Q energy counter
- Measured value simulation

| GSP274 - Grid Measurement | |
|---|---|
| Current/Voltage Measurement | |
| Measuring method | <ul style="list-style-type: none"> • True RMS (incl. harmonics up to 3 kHz) • Fundamental RMS (only fundamental) |
| Sampling rate | 100 μ s (10 kHz) |
| Measurement interval | 50 Hz: 10 ms 60 Hz: 8.33 ms |
| Individual samples | Intervals that can be retrieved via function calls in the user application: 100 μ s, 200 μ s, 400 μ s, 800 μ s, 1.6 ms (via block access) |
| Voltage Measurement | |
| Number | 7 (generator: L1,L2,L3,N / grid: L1,L2,L3,N / busbar Lx,Ly) |
| Maximum rated voltage | $U_{L-L, RMS}: 480 V_{rms}$ $U_{L-N, RMS}: 277 V_{rms}$ |
| Voltage measuring range | $U_{L-L, RMS}: 5$ to $718 V_{rms}$, $U_{L-N, RMS}: 3$ to $415 V_{rms}$ |
| Accuracy ¹⁾ | $\leq \pm 0.15 \%$ |
| Continuous overload | $U_{L-L, RMS}: 1021 V_{rms}$, $U_{L-N, RMS}: 590 V_{rms}$ |
| Short-term overload (10x10 s, Interval 10 s) | $U_{L-L, RMS}: 3637 V_{rms}$, $U_{L-N, RMS}: 2100 V_{rms}$ |
| Input impedance | $> 2 M\Omega$ |
| Current Measurement | |
| Number | 4 (generator: 3x, Generator star/neutral-point: X 1) |
| Accuracy ¹⁾ | $\leq \pm 0.08 \%$ |
| Current transformer rated current | $5 A_{rms}$ |
| Current measuring range | 0.01 to $9.5 A_{rms}$ |
| Response threshold | 1 mA |
| Continuous overload | $10 A_{rms}$ |
| Short-term overload (5x1 s, interval 300 s) | $100 A_{rms}$ |
| Apparent ohmic resistance | 250 mVA |
| Frequency Measurement | |
| Rated frequency | 50 / 60 Hz |
| Reference range | 50 Hz: 35 to 65 Hz 60 Hz: 45 to 75 Hz |
| Accuracy ¹⁾ | $\leq \pm 0.004$ Hz |
| Measurement interval | Updated at each positive zero crossing 1-conductor systems: 3-conductor systems: 50 Hz: 20 ms 50 Hz: 6.667 ms 60 Hz: 16.67 ms 60 Hz: 5.6 ms |
| Frequency change measurement | Yes |

1) Accuracy values as a percentage of the nominal value at 25 °C and reference conditions

| GSP274 - Grid Measurement | | | | | | | |
|--|---|----------------------|----------------------|--------------|-----------------|-----------------|---------------|
| Phase Measurement, Asymmetry | | | | | | | |
| Phase angle | Angles from current phasor to voltage phasor for each phase | | | | | | |
| Voltage system | Angles between the voltage phasors | | | | | | |
| Asymmetry voltage system | Quotient of negative and positive sequence system of voltages or rated voltage as percent value | | | | | | |
| Asymmetry current system | Quotient of negative and positive sequence system of currents or rated current as percent value | | | | | | |
| Field rotation direction | Detection for voltage and current system | | | | | | |
| Power Measurement – Active, Reactive and Apparent Power | | | | | | | |
| Measured values | P, Q, S per phase and as total | | | | | | |
| Accuracy ¹⁾ | ≤ ±0.2 % | | | | | | |
| Calculation methods | DIN 40110-2, IEC 61400-21 | | | | | | |
| Measurement interval | Updated at each positive zero crossing <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">1-conductor systems:</td> <td style="width: 50%;">3-conductor systems:</td> </tr> <tr> <td>50 Hz: 20 ms</td> <td>50 Hz: 6.667 ms</td> </tr> <tr> <td>60 Hz: 16.67 ms</td> <td>60 Hz: 5.6 ms</td> </tr> </table> | 1-conductor systems: | 3-conductor systems: | 50 Hz: 20 ms | 50 Hz: 6.667 ms | 60 Hz: 16.67 ms | 60 Hz: 5.6 ms |
| 1-conductor systems: | 3-conductor systems: | | | | | | |
| 50 Hz: 20 ms | 50 Hz: 6.667 ms | | | | | | |
| 60 Hz: 16.67 ms | 60 Hz: 5.6 ms | | | | | | |
| Energy | | | | | | | |
| Accuracy ¹⁾ | ≤ ±0.2 % | | | | | | |
| Resolution | 1 Ws | | | | | | |
| Active energy | Supplied (positive), drawn (negative) | | | | | | |
| Reactive energy | Supplied (positive), drawn (negative) | | | | | | |
| Type of memory | Nonvolatile (on the module) | | | | | | |
| Measurement interval | Updated at each positive zero crossing <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">1-conductor systems:</td> <td style="width: 50%;">3-conductor systems:</td> </tr> <tr> <td>50 Hz: 20 ms</td> <td>50 Hz: 6.667 ms</td> </tr> <tr> <td>60 Hz: 16.67 ms</td> <td>60 Hz: 5.6 ms</td> </tr> </table> | 1-conductor systems: | 3-conductor systems: | 50 Hz: 20 ms | 50 Hz: 6.667 ms | 60 Hz: 16.67 ms | 60 Hz: 5.6 ms |
| 1-conductor systems: | 3-conductor systems: | | | | | | |
| 50 Hz: 20 ms | 50 Hz: 6.667 ms | | | | | | |
| 60 Hz: 16.67 ms | 60 Hz: 5.6 ms | | | | | | |
| Power Quality | | | | | | | |
| Voltage | Total harmonic distortion (THD) per phase | | | | | | |
| Current | Total demand distortion (TDD) per phase | | | | | | |
| Voltage harmonics | Amplitudes of harmonics up to 50th harmonic per phase | | | | | | |
| Current harmonics | Amplitudes of harmonics up to 50th harmonic per phase | | | | | | |
| Calculation method | EN 61000-4-7 | | | | | | |
| Measurement interval | 50 Hz: Calculation over 10 periods 60 Hz: Calculation over 12 periods | | | | | | |
| Digital Inputs – Switch Position Indication | | | | | | | |
| Number | 4 (2 groups each with 2 inputs) | | | | | | |
| Signal rated voltages | 24 VDC | | | | | | |
| Input voltage range (H) | 15 to 34 VDC | | | | | | |
| Input voltage range (L) | -34 to 5 VDC | | | | | | |
| Internal resistance | 6.8 kOhm | | | | | | |
| Input delay (typically) | 1 ms | | | | | | |
| Status display (LED) | Green | | | | | | |

1) Accuracy values as a percentage of the nominal value at 25 °C and reference conditions

GSP274 - Grid Measurement**Digital Outputs – Synchronization and Alarming**

| | |
|--------------------------|--------------|
| Number | 4 |
| Signal rated voltages | 24 VDC |
| Output voltage range (H) | 18 to 34 VDC |
| Output current max. | 0.5 A |
| Status display (LED) | Green |

Digital Relay Outputs – Grid and System Protection

| | |
|-----------------------|--|
| Number/type | 2 changeover contacts |
| Signal rated voltages | 230 VAC, 48 VDC, 24 VDC (not mixed) |
| Output current max. | Nominal 0.5 A at +24 VDC, DC-13 Nominal 0.5 A at +24 VDC, resistive load Nominal 1 A at 230 VAC, AC-15 Nominal 2 A at 230 VAC, resistive load |
| Status display (LED) | Green |

GSP274 Limit Value Monitoring

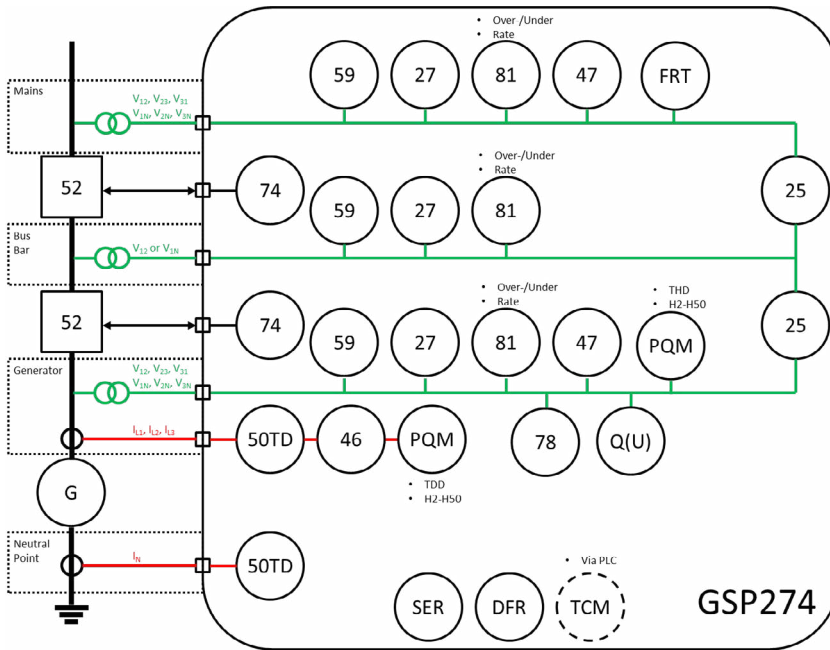


Figure 1: Available protection elements acc. to ANSI IEEE Std C37.2 – 2008 – overview

| GSP274 - Limit Value Monitoring | | |
|--|------------------------------------|----------------------------|
| Undervoltage/Overvoltage (ANSI 27/59) | | |
| Resolution | 0.1 % U_{Rated} | |
| Delay | 0 to 65535 ms | |
| Evaluated potentials | Phase-to-phase or phase-to-neutral | |
| Protection elements | U< | Undervoltage warning |
| | U<< | Undervoltage error |
| | U> | Overvoltage warning |
| | U>> | Overvoltage error |
| Underfrequency/Overfrequency (ANSI 81 U/O) | | |
| Delay | 0 to 65535 ms | |
| Protection elements | f< | Underfrequency inner band |
| | f<< | Underfrequency middle band |
| | f<<< | Underfrequency outer band |
| | f> | Overfrequency inner band |
| | f>> | Overfrequency middle band |
| | f>>> | Overfrequency outer band |

GSP274 - Limit Value Monitoring**Q(U)**

| | |
|-------------|---|
| Description | Voltage dependent directional reactive power protection. Used to support the voltage during grid faults. Trips if all three evaluated voltages are below a certain limit (e.g. $0.85 U_{Rated}$) and inductive reactive power is drawn from the power supply grid. |
|-------------|---|

Rate of Change of Frequency – ROCOF (ANSI 81 R)

| | |
|-------------|--|
| Description | To calculate the frequency change over time the last 10 (50 Hz) or 12 (60 Hz) frequency samples are linearly interpolated. |
|-------------|--|

Vector Jump (ANSI 78)

| | |
|-------------|--|
| Description | Monitoring of sudden phase shifts for detection of sudden load changes or islanding. |
|-------------|--|

Overcurrent (ANSI 50TD)

| | | |
|---------------------|----------------------|--|
| Resolution | 0.1 % of I_{Rated} | |
| Delay | 0 to 65535 ms | |
| Protection elements | I> I>> | Overcurrent warning Overcurrent error |

Time-dependent Undervoltage/Overvoltage Protection (VFRT)

| | |
|---------------------|--|
| Description | Time-dependent voltage monitoring is triggered if one of the three phase voltages (asymmetrical fault) or all voltages (symmetrical fault) fall below or rise above a curve $U(t)$ configured via interpolation points. Up to 11 time/voltage pairs are available to calculate a grid-code dependent limit curve. Four separate protection functions can be used with different parameter sets. (LVRT, HVRT) |
| Protection elements | $U(t)a>$, $U(t)b>$, $U(t)c>$, $U(t)d>$, $U(t)a<$, $U(t)b<$, $U(t)c<$, $U(t)d<$ |

Voltage Asymmetry Monitoring (ANSI 47TD)

| | |
|-------------|--|
| Description | Monitoring of the actual asymmetry of the voltage system against the given threshold value. The asymmetry calculation can be configured as ratio of the actual negative sequence voltage to the actual positive sequence voltage (EN 50160) or to the rated voltage. |
|-------------|--|

Current Asymmetry Monitoring (ANSI 46)

| | |
|-------------|--|
| Description | Monitoring of the actual asymmetry of the current system against the given threshold value. The asymmetry calculation can be configured as ratio of the actual negative sequence current to the actual positive sequence current (EN 50160) or to the rated current. |
|-------------|--|

Power Quality Monitoring – PQM

| | | |
|---------------------|--|--|
| Description | Monitors voltage and current harmonics up to the 50th harmonic. Trips if one of the pre-defined limits is exceeded (evaluation per phase). | |
| Protection elements | THD TDD H_2 to H_{50} H_2 to H_{50} | Total harmonic distortion Total demand distortion Individual amplitudes of voltage harmonics Individual amplitudes of current harmonics |



| GSP274 - Limit Value Monitoring | |
|---|---|
| Alarm Relays (ANSI 74) | |
| Description | Two relays for actuating the circuit-breakers are provided for single fault tolerant grid and system protection acc. to VDE-AR-4105. See Digital relay outputs |
| Synchronization Test Relays (ANSI 25) | |
| Description | Digital outputs control up to two circuit-breakers (2 DO per circuit-breaker). They are activated by the GSP module if the synchronization criteria are fulfilled. Pulse or continuous signal can be configured for the actuation. See Digital outputs |
| Black bus start | Yes |
| Trip Circuit Monitoring – TCM | |
| Description | Digital inputs are provided to monitor the actual switching state of the circuit-breakers. See Digital inputs |
| Time Synchronization | |
| Basic principle | GSP module is synchronized automatically with the real-time clock of the PLC-CPU. This can be synchronized via the network. |
| Physical medium | Ethernet (CPU) |
| Protocols | IEEE 1588 PTP (Precision Time Protocol) SNTP (Simple Network Time Protocol) |
| Event Logging with Real-time Stamp – SER (Sequence of Events Recorder) | |
| Description | Monitoring events (configured alarm/protection functions) are stored with a precise time reference when they occur. |
| Type of memory | Nonvolatile (on the module) |
| Size | 2048 entries |
| Real-time Data Recorder / Digital Fault Recorder – DFR | |
| Description | The GSP module is provided with 3 integrated real-time data recorders. One data recorder can be used for recording the synchronization sequence between the generator and busbar and one for busbar and grid. Another data recorder can carry out recordings when triggered by a monitoring function. |
| Number of channels | 16 channels (measured values, digital I/O, calculated values) |
| Memory depth per channel | 40,960 sampling values (4 s at 100 µs sampling rate) |
| Sampling rate | 100 µs, 200 µs, 400 µs, 800 µs, 1.6 ms |
| Pre-trigger | Yes |

| GSP274 - Module Properties | |
|---------------------------------|---|
| Electrical Safety | |
| Product standard | IEC/EN 61131-2 |
| Generic standard | IEC/EN 60664-1 |
| Pollution degree | 2 |
| Overvoltage category | 3 |
| Rated impulse withstand voltage | 5 kV |
| Protection class | 2 |
| Approvals / Certificates | |
| Generator Grid Connection | GER: VDE-AR-N 4105:2018, DIN VDE V 0124-100:2020, VDE-AR-N 4110:2018, FGW TR3 (Rev. 25), FGW TR8 (Rev. 9) UK: ENA G99/1/4:2019 USA: IEEE C37.90:2005 |
| Maritime & Offshore | ABS, BV, DNV, LR, KR, NK, RINA |
| Ambient Conditions | |
| Operating temperature | -30 to +60 °C (standard install position) |
| Rel. air humidity, operation | 5 to 95 % no condensation |
| Storage temperature | -40 to +85 °C |
| Rel. air humidity, storage | 5 to 95 % no condensation |
| Maximum operating height | 2,000 m above sea level (operation up to 4,500 m on request) |
| Power Supply | |
| Via backplane | +5 V ≤ 316 mA, +15 V ≤ 21 mA, -15 V ≤ 23 mA |
| External on the module | 24 V 110 mA |
| System Requirements | |
| Hardware | All M1 CPU families apart from ME203, SK1 backplane not required |
| Software | Recommended: M-Base 4.25 / SolutionCenter 2.25 or higher At least M-Base 3.90 / SolutionCenter 1.90 or higher (with restrictions) |

| Order Codes | | |
|--------------------|-------------|---|
| Item | Item No. | Description |
| GSP274 | 00019756-00 | Grid measurement, protection and synchronization module; 7x In 480V, 4x In 5A; 4x In 5A; 4x In 24V; 4x Out 24V; 2x Out Relay 24/48VDC, 230VAC; U-, I-, P-, Q-, f-measurement; 4Q-energy metering, integrated monitoring/protection functions, harmonic analysis, integrated realtime data recorder (16 channels); sequence of event log with realtime stamp |
| GSP274 CC | 00021759-00 | Like GSP274; ColdClimate (❄️) |
| Accessories | | |
| KZ-GSP274 B+C | 00023426-00 | Terminal set Phoenix cage clamp/screw (1x KZ 51/03; 3x KZ 51/06; 2x SS76/10) with labeling strip and coding elements |