

Reason DR60

Digital Recorder and PMU

The Reason DR60 is a centralized one-box multifunctional digital fault recorder (DFR). The small form factor, together with the ruggedness of design drawn from field experience in yard-mounted applications, ensures that the Reason DR60 can be installed in harsh utility and industrial environments. The high scalability in binary I/O counts along with modern communications such as IEC61850 Edition 2 and synchronization protocols such as MMS, GOOSE and PTP precision-timing, place the DR60 at the forefront of digital fault recording technology.

Full system awareness

The DR60 outstanding performance, high accuracy and complete set of functionalities provide data for several applications and analysis, such as:

- Fault Recorder (waveform and binary status);
- Disturbance Recorder;
- Sequence of Events Recorder (COMFEDE);
- Long-term trends Recorder;
- Revenue readings
- Asset Management

IEC 61850, born and bred

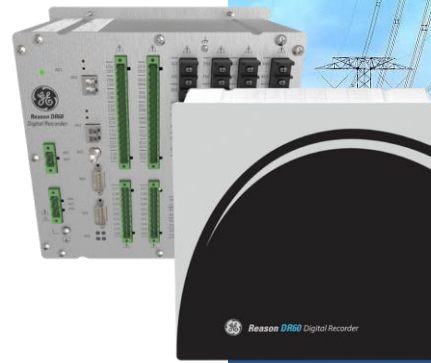
Born with IEC 61850 spirit, this is the DR60 motto. That means all its internal functions are implemented and mapped according to IEC 61850 ed.2 logical nodes and data models. Even its configuration is performed using native SCL files. It features MMS report control blocks for communication with supervisory systems and GOOSE publisher and subscriber for interaction with other IEDs through the IEC 61850 process bus.

Substation Protocols and Standards

The DR60 Digital Recorder offers what is best for high-quality measurements, synchronization, communication, and security. To do so, the DR60 utilizes well-recognized protocols for time synchronization and communication, such as: IEEE1588v2, MMS and GOOSE. The DR60 is full compliant with NERC CIP-5 and integration with Internet of Things (IoT) through Predix applications are scheduled for future firmware releases.

Ready for today's and tomorrow's substations

The DR60 is a modern and flexible solution that meets current and future application requirements granting the best that the IEC61850 has to offer to the customer's installations.



Situational Awareness

- Waveform recorder supporting 256 and 512 samples per cycle
- Disturbance and continuous disturbance recorder
- Trend Recorder & sequence of events recorder
- PMU IEEE C37.118.1/2-2011/1a-2014 compliance

High Density I/O

- Up to 32 analog inputs
- Up to 96 binary inputs and up to 48 binary outputs
- Up to 32 high-speed transducer inputs for HVDC applications

Communications

- Supporting industry standard protocols including DNP3, MMS and GOOSE
- Time synchronization including support for IEEE 1588 PTPv2 and IRIGB
- Serial (RS232 and Ethernet (RJ45 or LC) interfaces

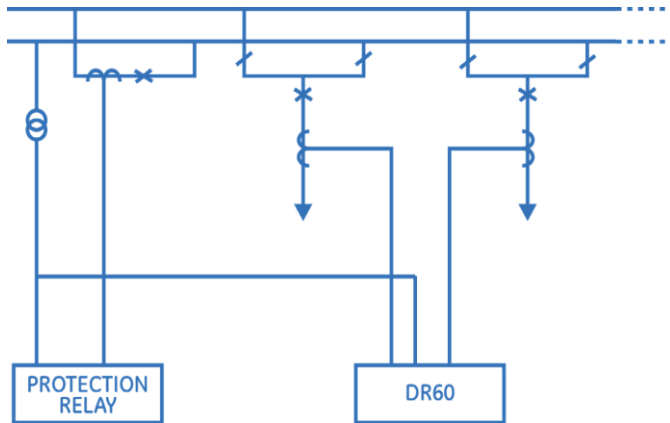
Application Flexibility

- Cross triggering
- Trigger matrix for easy output configuration and special logic schemes
- Native configuration in SCL format
- MMS report control blocks
- Back and front panel mounting

Phasor Measurement Unit (PMU)

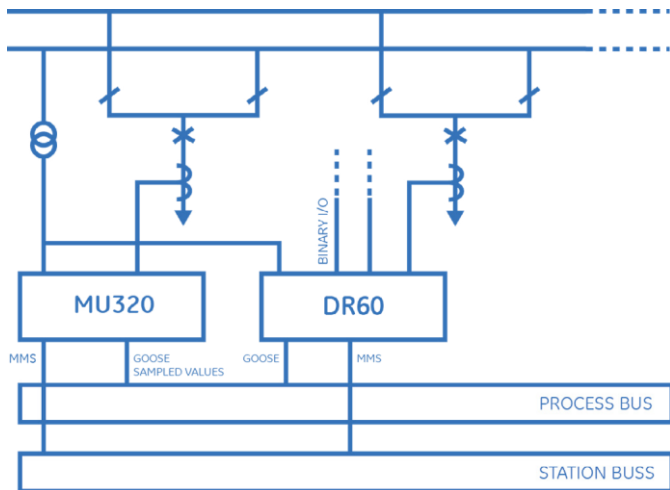
The DR60 provides powerful and cost-effective synchrophasor measurement solution according to IEEE C37.118.1/2- 2011/1a-2014 standard and is capable of transmitting its data in up to 4 separate data streams. Each stream can be configurable independently based on: contents; frame rate; Class of service (P or M) and communication mode (TCP or UDP).

DR60 architecture example: DFR-Monitoring-PMU



The DR60 can be installed to monitor and record analog and binary signals. Depending on the part number option, with a single DR60 it is possible to have: up to 32 analog inputs; up to 96 binary inputs; up to 32 high-speed transducer inputs for HVDC or up to 48 binary outputs.

DR60 architecture example: Extension I/O BOX



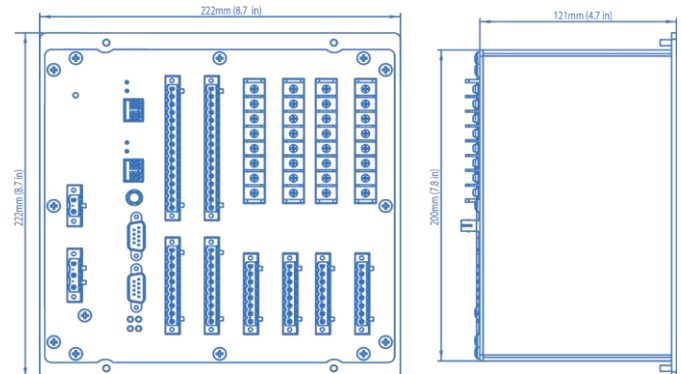
The DR60 can be used to translate the analog and binary signals into IEC 61850 standard protocol as GOOSE and MMS.

DC transducer inputs specifications

| Characteristic | Voltage transducer input | Current transducer input |
|-------------------|--------------------------|--------------------------|
| Measurement range | - 12.5 to + 12.5 V | - 25 to 25 mA |
| Accuracy | ± 0.1 % of FS | ± 0.1 % of FS |
| Impedance | > 5 kΩ | 10 Ω |

Dimensions of the equipment

| | |
|--------|-------------------------|
| Height | 222 mm / 8.7 in (5 U) |
| Width | 222 mm / 8.7 in (½ 19") |
| Depth | 121 mm / 4.7 in |
| Weight | < 3.5 kg (< 7.72 lb) |



Ethernet ports

| Type | Electrical | Optical |
|--------------------------|--|---|
| Use | Configuration, monitoring, communication, software upgrade, log download | |
| Interface | 10BASE-T / 100BASE-TX | 100BASE-FX |
| Bit Rate | 10 / 100 Mbps | 100 Mbps |
| Connector | RJ 45 | LC |
| Fiber type | --- | Multimode 62.5 / 125 μm 50 / 125 μm |
| Wavelength | --- | 1300 nm |
| Emission power | --- | -20 dBm |
| Sensitivity | --- | -32 dBm |
| Maximum applicable power | --- | -14 dBm |
| Isolation Level | 1.44 kVdc | --- |
| Possible Redundancy | Failover or PRP | |

Serial port

| | |
|-----------|---|
| Interface | RS232 |
| Use | Device configuration, change password, license upgrade and DNP3 |
| Bitrate | 115200 bps |
| Databits | 7 or 8 |
| Stopbits | 1 or 2 |
| Parity | None, even, odd |
| Connector | DB9 (female), standard DTE |

IRIG-B optical port

| | |
|-------------|--|
| Signal | IRIG-B004 |
| Wavelength | 820 nm |
| Fiber type | Multimode 62.5 / 125 μm or 50 / 125 μm |
| Connector | ST |
| Sensitivity | - 24 dBm |

Binary inputs specifications B1 and B2 (HW-A)

| | | |
|----------------------------------|------------------------------|----------------------------|
| Nominal Voltage | 125 / 250 Vdc | 24 / 48 Vdc |
| Level Low | 65 V | 8 V |
| Level High | 91 V | 13 V |
| Impedance | 120 kΩ | 14 kΩ |
| Burden (Vn) | < 0.14W@125V < 0.65W@250V | < 0.06W@24V < 0.18W@48V |
| Continuous Overload ¹ | 300 V | 100 V |
| Acquisition sampling rate | 256 and 512 spc | |

Binary inputs specifications B3 and B4 (HW-B)

| | | | | |
|----------------------------------|-----------------|--------|---------|--------|
| Nominal Voltage | 24V | 48V | 125V | 250V |
| Level Low | 08V | 10V | 40V | 75V |
| Level High | 17V | 19V | 85V | 160V |
| Impedance | 15kΩ | 16kΩ | 82kΩ | 164kΩ |
| Burden (Vn) | < 0.05W | < 0.2W | < 0.25W | < 0.5W |
| Continuous Overload ¹ | 50V | 100V | 170 V | 340 V |
| Acquisition sampling rate | 256 and 512 spc | | | |

Binary outputs

| Type | B2 | B4 |
|---|----------------------------------|-----|
| Description | Dry contact relay, normally open | |
| Switching Voltage | 250 V (AC and DC) | |
| Maximum continuous current | 3 A | 5 A |
| Maximum voltage | 300 (AC and DC) | |
| Making Capacity | 15 A, 4 sec | |
| Breaking Capacity | 40 W Resistive 25 W/VA L/R = 50 | |
| Operation time | < 5 ms | |
| Dropout time | < 15 ms | |
| Withstand voltages across open contacts | 1000 Vrms | |
| Permissible short time value for 1s | 30A | |

IN SERVICE contact specifications

| | |
|---|-----------------------------------|
| Description | Dry contact relay, normally close |
| Switching Voltage | 250 V (AC and DC) |
| Permissible current continuous | 5 A |
| Maximum voltage | 300 (AC and DC) |
| Making Capacity | 15 A, 4 sec |
| Breaking Capacity | 40W Resistive, 25 W/VA L/R = 50 |
| Dropout time | < 5 ms |
| Withstand voltages across open contacts | 1000 Vrms |
| Permissible short time value for 1s | 30A |

Voltage inputs specifications (50/60 Hz)

| Characteristic | Standard input | High Accuracy Inputs |
|-----------------------------------|-----------------------------|-----------------------------|
| Nominal Voltage (V _n) | 115 V | 115 V |
| Voltage range RMS | 0.25-460 V | 0.11-230 V |
| Analog Input Accuracy | Class 0.5 (IEC 61869-2) | Class 0.1 (IEC 61869-2) |
| Burden vn | < 0.1 VA | < 0.1 VA |
| Continuous Overload | 230 V (2 x V _n) | 230 V (2 x V _n) |
| Maximum Overload(1s) | 460 V (4 x V _n) | 460 V (4 x V _n) |
| Input isolation | > 3,5 kV | > 3,5 kV |

Current inputs specifications (50/60 Hz)

| Characteristic | Standard Input (P1) | Standard Input (P5) | High Accuracy Inputs (ME) |
|---|---|--|--|
| Nominal Current (I _n) | 1 A | 5 A | 1 and 5 A |
| Current range | 0.02... 40 A | 0.1... 200 A | 0.005... 10 A |
| Analog Input Accuracy | Class 0.5 (IEC 61869-2) ¹ 0,05In to 40In better than 0,1% of the measurement ± 2mA <0,1% of full scale | Class 0.5 (IEC 61869-2) ¹ 0,05In to 0,2In better than 0,15% of the measurement ± 5mA 0,2In to 0,5In better than 0,1% ± 2mA of measurement 0,5In to 40In better than 0,1% of measurement <0,1% of full scale | Class 0.1 (IEC 61869-2) ¹ 0,05In to 4In better than 0,1% of the measurement ± 1mA <0,1% of full scale |
| Burden In | < 0.02 VA | < 0.05 VA | < 0.02 VA |
| Continuous overload (rms) | 4 A (4 x I _n) | 20 A (4 x I _n) | 10 A |
| AC current thermal withstand (I _{th} rms for 1s) | 40A (40xI _n) | 200A (40xI _n) | 20 A |
| Input Isolation | > 3.5 kV | > 3.5 kV | > 3.5 kV |

Analog acquisition

| System Frequency | Points per cycle | Acquisition Frequency | Bandwidth |
|------------------|------------------|-----------------------|---------------|
| 50Hz | 256 ppc | 12800Hz | DC to 3150Hz |
| 60Hz | 256 ppc | 15360Hz | DC to 3780Hz |
| 50Hz | 512 ppc | 25600Hz | DC to 10000Hz |
| 60Hz | 512 ppc | 30720Hz | DC to 10000Hz |

Type Test

EMC tests were performed according to IEC 60255-26 referring to the following

| | | |
|---|--|---|
| Electrostatic discharge | IEC 61000-4-2:2008 | 6kV contact / 8kV air (level 3) |
| RF immunity | IEC 61000-4-3:2006 | 10 V/m (level 3) |
| Fast transient disturbance | IEC 61000-4-4:2012 | Zone A - 4kV @ 5kHz |
| Surge immunity | IEC 61000-4-5:2005 | Zone A Differential mode: 4kV Common mode: 2kV |
| Conducted RF immunity | IEC 61000-4-6:2008 | 10 V/m (level 3) 0.15 MHz to 80 MHz |
| Power magnetic immunity | IEC 61000-4-8:2009 | 30A/m continuous - 300A/m @ 1s (level 4) |
| Voltage dip, short interruptions and voltage variation immunity tests | IEC 61000-4-11:2004 | AC dips (residual%) 0% - 1/1 cycles (50/60Hz) 40% - 10/12 cycles (50/60Hz) 70% - 25/30 cycles (50/60Hz) AC interrupt (residual%) 0% - 250/300 cycles (50/60Hz) |
| | IEC 61000-4-29:2000 | DC dips (residual%) 0% - 10ms 40% - 200ms 70% - 500ms DC interrupt (residual%) 0% - 5s |
| Power Frequency | IEC 61000-4-16:1998 | Zone A Differential mode: 150Vrms Common mode: 300Vrms |
| Voltage ripple | IEC 61000-4-17:1999 | Test level: 15 % of rated dc. value Test frequency: 100/120Hz, sinusoidal waveform |
| Damped oscillatory wave immunity test | IEC 61000-4-18:2006 | Voltage oscillation frequency: 1MHz Differential mode: 1kV peak voltage Common mode 2,5kV peak voltage |
| Gradual Startup | IEC 60255-26:2013 | Shut-down ramp: 60s Power off: 5min. Start-up ramp: 60s |
| Radio-frequency disturbance | CISPR11:2009 (below 1GHz) | Radiated emission below 1GHz - class A 30 MHz to 230 MHz 40 dB(μV/m) quasi peak at 10 m 50dB (μV/m) quasi peak at 3m 230 MHz to 1 000 MHz 47 dB(μV/m) quasi peak at 10 m 57dB (μV/m) quasi peak at 3m |
| | | Radiated emission CISPR22:2008 (above 1GHz) |
| Radiated emission | CISPR22:2008 (above 1GHz) | 1 to 3 GHz - 56dB(μV/m) Average; 76dB (μV/m) peak at 3m 3 to 6 GHz - 60dB(μV/m) Average; 80dB (μV/m) peak at 3m |
| Conducted emission | CISPR22:2008 | 0.15MHz to 0,50MHz; 79dB(μV) quasi peak; 66dB(μV) average 0.5MHz to 30MHz; 73dB(μV) quasi peak; 60dB(μV) average |
| Safety tests | | |
| IEC 60255-27:2013 | Impulse – 5kV Dielectric withstand – 2.2 kVrms Insulation resistance > 100MΩ @ 500 Vdc | |
| Environmental tests | | |
| IEC 60068-2-1 | -40°C, 16 hours (Cold operational) | |
| IEC 60068-2-1 | -40°C, 16 hours (Cold storage) | |
| IEC 60068-2-2 | +85°C, 16 hours (Dry heat) | |
| IEC 60068-2-2 | +85°C, 16 hours (Dry heat operational) | |
| IEC 60068-2-2 | +85°C, 16 hours (Dry heat storage) | |
| IEC 60068-2-30 | +25°C ± 3°C – 95% ±3% RH | |
| | +55°C ± 2°C – 93% ±3% RH 6 of 24 hours (12h + 12h) cycles | |
| IEC 60068-2-14 | -40°C to 55°C / 9 hours / 2 cycles (Change of temperature) | |
| IEC 60068-2-78 | +40°C ±2°C –93% ±3% RH –10 days (Damp heat) | |
| IEC 60255-21-1 | Vibration Response and Endurance Class 2 | |
| IEC 60255-21-2 | Shock Response and Endurance Class 1 | |
| IEC 60255-21-2 | Bump Class 1 | |
| IEC 60255-21-3 | Seismic Class 2 | |

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