



## FULL FEATURED SATELLITE CLOCK

## TCG 02-G

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The TCG 02-G is a highly accurate, full featured GPS and GLONASS (GNSS) clock. Offering multiple oscillator options, Time Code and Frequency outputs, it fits virtually any timing application. With enhanced cyber security features that support NERC CIP requirements, the TCG 02-G is designed for use in modern day smart grid / smart substations, electricity distribution, transmission, and generation protection. In addition industrial application systems and traditional substations are equally provided for. This master clock synchronizes multiple IEDs (Intelligent Electronic Devices) within a network, including protection relays, synchrophasors, event recording and remote telemetry units to enable accurate time stamping. The TCG 02-G is available as a base unit or with one of three expansion module options.

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### KEY FEATURES

- References GPS and GLONASS networks
- Multi-level password protection
- Isolated singular or dual power supplies
- High power line drivers
- Low noise characteristics due to balanced pair distribution
- UTC and LST with user defined DST options
- Master/ Slave function
- Up to 9 outputs
- Supports IEC61850
- Enhanced Security and encryption that exceed NERC CIP requirements
- Remote configuration and firmware upgrades
- OCXO/Atomic options

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### SUPPORTS

- DC IRIG-B or Modified Manchester: TTL, RS232, RS422/RS485, HV MOSFET
- AM IRIG-B (Modulated)
- Serial Strings
- User defined pulses
- DCF77
- Frequency outputs
- T1/E1/J1 support
- Event Recording
- NTP/SNTP (IEC 61850)
- PTP (IEEE 1588 v2, Power Profile C37.238, and Telecom Slave profile ITU G.8265.1)



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## PHYSICAL

19" rack mount 1U high  
(W) 430 mm x (D) 270 mm x (H) 45 mm, 2.0 kg  
IP40 (Ingress Protection rating)

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## FRONT PANEL

The TCG 02-G has a 2 line x 16 character FSTN LCD display and two LEDs indicating multiple statuses, including:

- Sync Status
  - Antenna cable fault
  - Satellite acquisition mode
  - Display mode button
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## GNSS RECEIVER

L1, C/ A code, 32 Channel Parallel-tracking receiver

Frequency: 1598 MHz  
Sensitivity:  
Acquisition -155 dBm  
Tracking -160 dBm

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## OSCILLATOR - TCXO

Holdover characteristics operating at 25 degrees C;  
- TCXO 1PPS drifts 0.55 ms over a 24 hour period.  
- Drift rate: 7 ppb per second

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## INPUTS AND OUTPUTS

2 x independently programmable outputs, either:

TTL 0 - 5 V, 150 mA (BNC or 2-pin)  
RS422 +/- 5 V, 50 loads (2-pin)  
HV switch MOSFET 300 V 1 A (2-pin)  
Fiber TX ( 62.5/ 125  $\mu$ m,  $\lambda$  820 nm), compatible with multi-mode fiber (ST Fiber connectors)  
Timing accuracy: <100 ns to UTC

### Plus:

1 x RS232/ RS422 serial port, DCE wired (DB9)  
RS232: Signals are +/- 9 V, 15 mA.  
RS422 +/- 5 V, 50 unit loads  
Serial time messages can be configured to be output at 1200, 2400, 4800, 9600, 19200 and 38400 baud.  
The signal output ON P4 Pin1 is the same as programmed on the programmable output on the expansion module.

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Timing accuracy of RS232/ RS422 port:

Serial Message: <1 bit time  
Pulse/ or IRIG-B time code: <1.5  $\mu$ s to UTC

### Plus:

1 x AM IRIG-B, 9 Vpp, 120 ohm (BNC)  
Timing accuracy: <2  $\mu$ s to UTC

### Plus:

2 x Power supply alarms (Form A contacts)  
Contact rating: 200 V, 150 mA DC or 150 V, 100 mA AC

### Plus:

1 x Antenna fail alarm (2 pin - Form A contact)  
Contact rating: 200 V, 150 mA DC or 150 V, 100 mA AC

### Plus:

1 x Sync relay (2 pin - Form A contact)  
Contact rating: 200 V, 150 mA DC or 150 V, 100 mA AC

### Plus:

### Network Time Server Port

1 x RJ45 10/100 Mbps UTP connector  
Timing accuracy: <100 ns to UTC  
This UTP network interface option allows the TCG 02-G to function as a Stratum 1 NTP/ SNTP Time Server.

Protocols Supported:

ARP, UDP, ICMP, TFTP, DHCP, SNMP V1, V2 & V3; VLAN.

### IEEE 1588 v2 support

As per Network Time Server above plus:-  
PTP (IEEE1588) v2 operation  
GrandMaster (GNSS) or ordinary clock functions  
Profile selection:  
- Default  
- C37.238 Power Profile (full support)  
- Telecom Profile (slave only, ITU 6.8265.1)  
1-step tx, 1-step/ 2-step rx  
Layer 2 or Layer 3 mapping  
Peer to Peer and End to End delay support  
Typical clock PPS accuracy (single sub-net) <100 ns



Back Panel

## EXPANSION OPTIONS



### Expansion Module 1

2 x isolated digital inputs which can be configured for synchronization to an external TTL DC IRIG-B source and/ or event recording: 0-5 V TTL (BNC)  
Timing accuracy: <100 ns to UTC

#### Plus:

1 x Programmable output, either:  
TTL 0 - 5 V, 75 mA (BNC) or Fiber Digital TX (62.5/125  $\mu\text{m}$ ,  $\lambda$  820 nm), compatible with multi-mode fiber (ST Fiber connectors)  
Timing accuracy: <100 ns to UTC

#### Plus:

4 x IRIG-B outputs, either:  
IRIG-B switchable between TTL 0 - 5 V, 25 mA and AM IRIG-B (BNC) or Fiber Digital IRIG-B TX (62.5/125  $\mu\text{m}$ ,  $\lambda$  820 nm), compatible with multi-mode fiber (ST Fiber connectors)  
Timing accuracy TTL/Fiber <200 ns to UTC  
Timing accuracy AM IRIG-B: <2  $\mu\text{s}$  to UTC



### Expansion Module 2

1 x Network time server port - RJ45 connector  
10/100 Mbps  
Timing accuracy: <100 ns to UTC  
This UTP network interface option allows the TCG 02-G to function as a Stratum 1 NTP/SNTP Time Server.

Protocols Supported:  
ARP, UDP, ICMP, TFTP, DHCP, SNMP V1, V2 & V3; VLAN.

#### Plus:

2 x isolated digital inputs which can be configured for synchronization to an external TTL DC IRIG-B source and/or event recording: 0-5 V TTL (2 pin)  
Timing accuracy: <100 ns to UTC

#### Plus:

1 x Programmable output, either:  
TTL 0 - 5 V, 75 mA (BNC) or Fiber Digital TX (62.5/125  $\mu\text{m}$ ,  $\lambda$  820 nm), compatible with multi-mode fiber (ST Fiber connectors)  
Timing accuracy: <100 ns to UTC

#### Plus:

4 x IRIG-B outputs, either:  
IRIG-B switchable between TTL 0 - 5 V, 25 mA and AM IRIG-B (BNC)  
Fiber Digital IRIG-B TX (62.5/125  $\mu\text{m}$ ,  $\lambda$  820 nm), compatible with multi-mode fiber (ST Fiber connectors)  
Timing accuracy TTL/Fiber <200 ns to UTC  
Timing accuracy AM IRIG-B: <2  $\mu\text{s}$  to UTC



### Expansion Module 3

1 x Programmable output, either:  
TTL 0 - 5 V, 75 mA (BNC) or Fiber Digital TX (62.5/125  $\mu\text{m}$ ,  $\lambda$  820 nm), compatible with multi-mode fiber (ST Fiber connectors)  
Timing accuracy: <100 ns to UTC

#### Plus:

3 x IRIG-B outputs, either:  
IRIG-B switchable between TTL 0 - 5 V, 25 mA and AM IRIG-B (BNC)  
Fiber Digital IRIG-B TX (62.5/125  $\mu\text{m}$ ,  $\lambda$  820 nm), compatible with multi-mode fiber (ST Fiber connectors)  
Timing accuracy TTL/Fiber <200 ns to UTC  
Timing accuracy AM IRIG-B: <2  $\mu\text{s}$  to UTC

#### Plus:

2 x T1/E1/10M BNC outputs  
T1, E1 and 10M modes are software configurable  
Switchable between sine and square wave formats

#### Plus:

2 x T1/E1/J1 RJ48 outputs  
T1, E1 and J1 modes are software configurable

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## ENVIRONMENTAL AND ELECTRICAL

Power Supply\*: L=14-36 Vdc (2 pin)  
M=20-75 Vdc (2 pin)  
H=90-300 Vdc (2pin)  
I=85-265 Vac (IEC320 inlet)

\*Redundant power supply optional

Power drain: 12W max  
Operating temperature: -10 to 65°C  
Humidity: 10 to 95% RH  
(non condensing)

Isolation:  
Outputs to base unit: 2.5 kV  
Power supply to I/O: 3.5 kV

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## CONFIGURATION SOFTWARE

Windows based configuration software is available for download on the Tekron website.

Remote configuration over Ethernet includes the following user adjustable features:

- Multi-level access control
- Privacy & authentication methods equivalent to SNMP USM
- "Supervisor-mode" prevents non-approved changes
- Test mode
- Commissioning tool

### Timing & Synchronization

Worldwide daylight savings and local time configuration using either rule based or fixed date methods. Options that allow equipment checks prior to full installation and adjustable hold-over times to increase reliability in the case of poor GNSS coverage. Adjustments to compensate for installation parameters such as delay of GNSS signal through antenna cable.

### Programmable Outputs

IRIG-B (B00x / B22x) time code with selectable C37.118.1 and AFNOR S87-500 extensions  
DCF77 time code 1 kHz square wave  
User defined pulse sequences:  
Repetition rates from 20 ms to 24 hours  
Offsets and durations from 10 ms to 24 hours

### Serial Strings

NMEA-0183 ZDA  
NMEA-0183 RMC  
IRIG J-17  
Tekron A - G (Seven protocols for plug and play compatibility with a wide range of equipment).

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## SNMP

v1, v2c & v3 support can be independently enabled  
Configurable v1, v2c community names & security groups  
Fully configurable via SNMP  
v3 User-based Security Module (USM) support  
USM authentication methods: MD5, SHA  
USM privacy methods: DES, AES  
USM MIB support  
Notifications  
SNMP trap generation v1, v2c & v3  
SNMPv3 traps can be authenticated & privatised via USM  
Syslog (RFC-3164 & 5424 verities)

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## OPTIONAL ACCESSORIES

### Physical

- GNSS antenna
- Antenna cable
- Adjustable antenna mount
- Lightning protection kit

Refer to [tekron.com](http://tekron.com) for full technical specifications.

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## OSCILLATOR OPTIONS

### OCXO

#### 1PPS

Precision:  
<±50ns UTC Time

Holdover Characteristics:  
<±5 µs/8 hours (48-hours aging)  
±10 µs/18 hours (48-hours aging)  
±10 µs/24 hours (7-days aging)

### 10MHz

Stability:  
<±1.0x10<sup>(-9)</sup> Peak to Peak

Precision:  
<±1.0x10<sup>(-12)</sup> Avg per 24 hours  
<±1.0x10<sup>(-10)</sup> Root Allan  
Variance (tau=1 second)

Holdover Characteristics:  
<±1.0x10<sup>(-10)</sup> / 24 hours Common to 48-hours aging and 7-days aging

### Atomic

Please contact Tekron for information

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## ABOUT TEKRON

Tekron is a leading developer of accurate GPS/GLONASS clocks and time synchronisation solutions for use in industrial applications.



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## CONTACT US

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**Note:**  
The quickest and most effective method to request a quote is through the online quote request form on the Tekron website.