

TCG 01-G

Time Code Generator



Features

- References GPS and GLONASS networks
- Multi-level password protection
- Isolated singular power supply
- High-power line drivers
- Low-noise characteristics due to balanced-pair distribution
- Coordinated Universal Time (UTC) and Local Standard Time (LST) with user-defined Daylight-Saving Time (DST) settings
- Up to three independent Ethernet connections
- Enhanced security and encryption designed to meet NERC CIP 007-01 requirements
- Remote configuration and firmware upgrades

Applications

- Synchronization of station- and bay-level equipment
- Time synchronization for digital substation with process bus
- Industrial automation and Supervisory Control and Data Acquisition (SCADA)

Flexibility

Legacy substations often require compatibility with established time synchronization protocols such as IRIG-B, Pulse Per Second (PPS), and serial time codes. The TCG 01-G offers flexible power supply options, enabling operation across different voltage levels and simplifying integration with existing infrastructure. Depending on the interface required, the TCG 01-G can be fitted with a variety of connector types to support the unique requirements of each substation.

Resilience

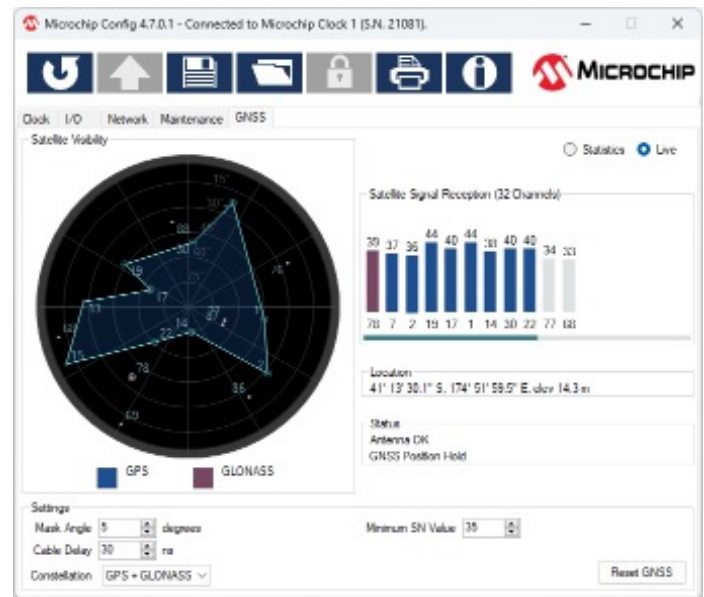
The TCG 01-G includes redundancy features designed to support uninterrupted time synchronization in legacy environments. Dual redundant power supplies provide backup in the event of a primary supply failure, maintaining continuous operation. Multiple independent output channels, including IRIG-B and serial outputs, enable distribution of time signals to critical devices, while reducing single points of failure. Logical isolation of outputs and independent channel configuration further enhance system reliability and security.

Security

Security is a key consideration in legacy substation time synchronization. The TCG 01-G provides secure management interfaces, including password protection and role-based access, to help prevent unauthorized changes or tampering. Reliable, synchronized timestamps support event logging, fault analysis and evidence gathering in environments where security and traceability are critical.

Configuration Tool

The TCG 01-G is configured using the Microchip power utility timing systems configuration tool. This common executable tool is used to configure all current-generation power utility timing system products. It provides an easy-to-use, secure interface that allows configuration of all available output options and status displays for performance monitoring.



Time Accuracy Output Suppression

Within the substation, it is critical that the time delivered to end devices can be trusted to be as accurate as possible. The TCG 01-G includes time accuracy output suppression. If the clock deviates beyond a user-configured threshold, the unit suppresses the output to prevent distribution of inaccurate time and potential false trips.

Holdover Accuracy (One Day)

Oscillator	Holdover Drift (first 24 hours)
TCXO	< 550 microseconds

Industry Standard Protocols

The power industry uses several standardized timing protocols. The TCG 01-G has the flexibility to support all relevant timing needs.

Key protocols supported include:

- Precision Time Protocol (PTP)
- Network Time Protocol (NTP)
- IRIG-B (B004–B007)
- Programmable pulses such as PPS, Pulse Per Minute (PPM) and Pulse Per Hour (PPH)
- DCF77

Output Accuracy to UTC

Output	Accuracy
TTL or fiber	< 100 ns
AM IRIG-B	< 2 μ s
1 PPS	<100 ns
PTP time stamp	< 100 ns
NTP time stamp	< 50 μ s

Mechanical/Environmental

Specification	Details
Size	(W) 160 mm $\times$ (D) 155 mm $\times$ (H) 40 mm
Low voltage power supply - 2 Pin	14–36 VDC
Medium voltage power supply- 2 Pin	20–75 VDC
High voltage (DC) power supply – 2 Pin	90–250 VDC
Power Drain	6W
Operating Temperature	-10 to +65°C
Storage Temperature	-10 to +85°C
Operational Humidity	$\leq$ 95%, non-condensing
Certifications	CE, FCC, CSA, RCM EN: 55 032:2015
Weight	0.8 kg
Ingress Protection	IP40

Specifications

GNSS Receiver

- 32 parallel-channel GNSS receiver
- Acquisition time
- Cold start: 26 seconds
- Hot start: 2 seconds
- Cable delay compensation configuration
- Available constellations
- GPS L1
- GLONASS L1

LCD Display and LEDs

- Two-line by 16-character Film Super-Twister Nematic (FSTN) LCD
- Displays sync status, clock information, satellite acquisition status and alarm information
- Two LEDs indicating sync and alarm status

Network Protocols (General)

- Dynamic Host Configuration Protocol (DHCP)
- Auto-configuration with fallback to Address Resolution Protocol (ARP)-tested link-local address
- Virtual LAN (VLAN) packet tagging
- Auto-MDIX
- Auto-negotiation
- Internet Protocol version 4 (IPv4)

Network Time Protocol (NTP Network) *

- Supports NTP versions 1, 2, 3, and 4
- Optional Message Digest 5 (MD5) authentication
- Multicast and broadcast server capability
- Stratum 1 NTP and Simple Network Time Protocol (SNTP) time server

Precision Time Protocol (PTP)*

- One- or two-step operation
- End-to-end, peer-to-peer or manual delay calculations
- Layer 2 (Ethernet) or Layer 3 (UDP) transport
- Server and client-only mode
- Default profile support
- Power profile support (IEEE C37.238-2011 and IEEE C37.238-2017)
- Telecom profile support (ITU- T G.8265.1 client only)
- Telecom profile support (ITU- T G.8275.1 server and client)
- Power utility profile (IEC 61850-9-3)
- IEEE C37.238 -2011 Type, Length, Value (TLV) supported
- Alternate time offset TLV supported with automatic or manual offset
- C37.238-2011 Simple Network Management Protocol (SNMP) Management Information Base (MIB) Supported

* Some optional features may incur additional costs

Simple Network Management Protocol (SNMP) and Syslog

- SNMP versions 1, 2c and 3 support, independently configured
- Configurable community names and security groups for SNMP v1 and v2c
- Fully configurable via SNMP
- SNMP v3 User-based Security Module (USM) support
- USM authentication methods: MD5 and Secure Hash Algorithm (SHA)
- USM privacy methods: Data Encryption Standard (DES) and Advanced Encryption Standard (AES)
- USM MIB support
- SNMP trap generation for versions 1, 2c and 3
- Authenticated and encrypted SNMP v3 traps via USM
- Syslog support per RFC-3164 and 5424

IRIG-B

- Direct Current Level Shift (DCLS) IRIG-B (B00x*) with configurable C37.118.1-2011 and AFNOR S87-500 extensions
- Amplitude-modulated (AM) IRIG-B (B12x*)
- Modified Manchester (B22x*)

*Where x is 4, 5, 6 or 7

Programmable Pulse

- User-defined pulse duration, offset and interval
- 1 PPS, 1 PPM, 1 PPH, 1 PPD

IRIG-B Input

- DCLS IRIG-B input
- Event recording

DCF77

- DCF77-time code
- 1 kHz square wave

Serial String

- NMEA-0183 ZDA
- NMEA-0183 RMC
- IRIG J-17
- String A -H

Port Isolation

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

Alarm Relays

- Two Form A contacts
- Antenna alarms
- Sync relay

TCG 01-G Specification

Front Panel

Specification	Details
Display	Two-line × 16-character FSTN backlit display
Buttons	One display button
LEDs	One green sync LED and one red alarm LED

Back Panel

Specification	Details
P1	Low, 2-pin, 14–36 VDC or Medium, 2-pin, 20–75 VDC or High, 2-pin, 90–250 VDC
GNSS Input	One 5V, SMA antenna connection, single-band GNSS receiver
P2	BNC, DC IRIG-B, DCF77 or pulse, TTL: 0–5V, 150 mA or ST fiber, unmodulated IRIG-B, DCF77 or pulses, 62.5/125 μm λ 820 nm or HV MOSFET, IRIG-B, DCF77 or pulses, 250 VDC, 1A or 2-pin, IRIG-B, DCF77 or pulses, RS422, ± 5 V

Specification	Details
P3	BNC, DC IRIG-B, DCF77 or pulse, TTL: 0–5V, 150 mA or ST fiber, unmodulated IRIG-B, DCF77 or pulses, 62.5/125 μm λ 820 nm or HV MOSFET, IRIG-B, DCF77 or pulses, 250 VDC, 1A or 2-pin, IRIG-B, DCF77 or pulses, RS422, ± 5V
P4	DB9 RS232 and RS422
P5	AM IRIG-B (B12x) ± 8 VDC
P6a	2-pin event recording/IRIG-B input
P6b	2-pin event recording/IRIG-B input
P7a	2-pin antenna alarm Form A relay
P7b	2-pin synchronization alarm Form A relay
ETH1	RJ45, admin port, 10/100 Mbps, auto-negotiation

