

Reference Options

- GPS
- NTP
- Time Code
- High Stability Oscillator
- NMEA 0183
- NENA 911 PSAP Standard

Output Options

- NTP
- Time Code
- Truetime/Kinematics
- NMEA 0183
- NENA 911 PSAP Standard
- PPO
- PPS
- 10MHz sine wave



The MCR1000 Master Clock Reference system is a compact, precision time and frequency device.

One unit can reference and output NTP, time code, and 10 MHz sine wave all locked to the Atomic Clocks in the GPS satellites with a high stability crystal oscillator backup in the case that GPS signal is lost.

With specifications that are equal or better than almost any other similar product the MCR is up to 60% less expensive than its competition.

The MCR1000 is available in multiple configurations to fit almost any need with configurable modules.

Rack mountable with an RM4



MODULAR FEATURES

Reference Sources

- Atomic Clocks in GPS Satellites via GPS Antenna
- NTP via Ethernet
- Time Code - IRIG A, B, and E, SMPTE, EBU
- High stability OXCO oscillator $\pm .25$ min/year
- NMEA 0183 via RS-232 or USB
- NENA Format 0, 1, and 8 via RS-232 or USB

Outputs

- PC time set via USB serial
- NTP - client via 10/100 Mb Ethernet
- Time Code - IRIG A, B, and E, SMPTE, EBU
- NMEA 0183 via RS-232 or USB
- NENA Format 0,1, and 8 via RS-232 or USB
- 5V at 20mA Pulse Per Second and Programmable Pulse Output
- 10MHz sine wave
- DB9 - Breakout adapter

Other Features

- Programmable relay closure. 1 event per day with NO / NC dry contact relay, 24V - AC/DC (250mA max)
- 6 or 9 digit display
- Optional relay scheduler for multiple events

Physical

Size: 6.75 x 4.13 x 1.5 in **Weight:** 17.3 oz
17.15 x 10.48 x 3.81 cm 490.5 g

Power

- DC input
- Threaded locking plug with wallwart (transformer)

Humidity

Operating Temperature and Humidity

- Temperature: 0 to +60°C (0 to 40°C ± 1 min/year)
- Humidity: Up to 90%, non-condensing

In depth module datasheets on the following pages.

FEATURES	Basic MCR Units
Manual time set via network & USB	√
NENA In/Out (Format 0, 1, and 8)	√
NMEA 0183 In (ZDA, GGA, GLL, RMC)	√
NMEA 0183 Out (ZDA)	√
NTP Input client software	√
PPS	√
Relay programmable – 1 event	√
RS232 Port	√
TCXO oscillator ± 1 Min / year	√
TELNET network setup software	√
Time/Date data output via USB	√
USB Port	√
Windows USB setup software	√
Windows network setup software	√



Basic MCR1000

FEATURES	Modules and Add-ins							
	GPS (M)	TCR (M)	TCG (M)	NTP (F)	HSO (M)	PPO (M)	LED Display (M)	Event Time (S)
Direct Links for Quick Navigation *	3	4	5		7	8	9	9
10 MHz Output Sine Wave					√A			
Atomic Clock Accuracy	√							
IRIG-A & E Generator			√A					
IRIG-A & E Reader		√A						
IRIG-B & SMPTE/EBU Time Code Generator			√					
IRIG-B & SMPTE/EBU Time Code Reader		√						
Nine Digit Display							√	
Additional NMEA 0183 Out (ZDA, GGA, GLL, GSA, GSV, RMC, VTG)	√							
NTP Time Server Function				√				
OCXO oscillator ± .25 Seconds/Year					√			
PPO - Programmable Pulse Output						√		
Relay programmable – Multiple Event								√
Six Digit Display							√	
Time Code Format Translation		√	√					

LEGEND

√ Module/Add-in provides selected feature.

√A Advanced version of option provides selected feature.

* Clicking the numbers on this row will send you to the corresponding page.

Key Features

- Receives time simultaneously from up to 12 satellites utilizing the GPS satellite system
- Provides accurate reference to within ± 100 nS of UTC
- NMEA-0183 messages on serial port output with option installed
- Provide most accurate external time source for MCR
- Includes either Standard Antenna or Basic Antenna Package
- Antenna cable lengths up to 500'/152 m available
- In-line surge arrestors and in-line GPS amplifiers available
- Compact design for portable applications
- May be added to **MCR1000** or **MCR5000**

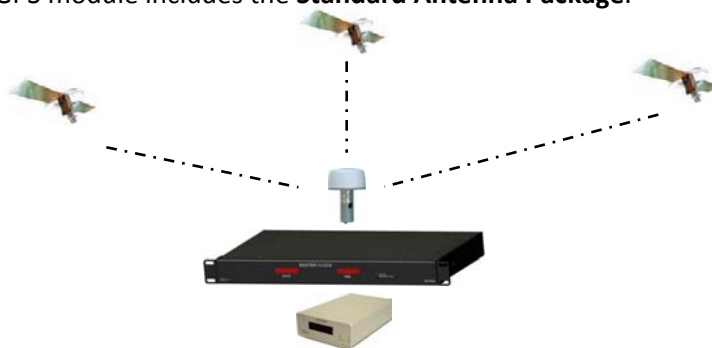
Masterclock's MCR-GPS (GPS Receiver) is an add-in module option for Master Clock Reference Devices. It provides a precision time reference based upon the Global Positioning Satellite System.

The GPS option maintains and provides an excellent atomic time reference based on reception of time from up to 12 GPS satellites simultaneously.

NMEA-0183 satellite and date/time information messages available on serial port with option installed. PPS on-time output locked to top of second.

Each MCR may be ordered with an MCR-GPS module option (MCR1000, MCR5000, and MCRPCIe).

The GPS module includes the **Standard Antenna Package**.



MCR-GPS Module

Specifications	Receiver
Satellites	12 Channel, up to 12 satellites simultaneously, parallel
Frequency	L1, 1575 MHz
Antenna Connector	SMA Female
RF Bias to Antenna	3V DC, Center Pin
PPS	4 μ s, TTL level, on-time leading edge
Accuracy	± 100 nS of UTC
	Antenna
Type	Active, External
Gain	32 dB
Mount	Outdoor, threaded pipe/mast. M24 x 1.5 internal thread. Mounting kit provided.
Operating Temperature	-40° to 85°C, (high humidity)
Voltage	3/5 VDC, center pin
Power Consumption	.24 W @ 22 mA
Polarization	Right Hand Circular
Weight	4.9 oz (140 g)
Impedance	50
Dimension	3.7" diameter x 4.9" length (96mm x 126mm)
Connector	SMA Female
Antenna Cable	50' (15m) Beldin 8219, 50 Ohm low loss with SMA male connectors

Key Features

- Reads and synchronizes to SMPTE & IRIG time codes
- Software controlled
- Optional Advanced Time Reader (see below)
- Autodetection and automatic gain control of incoming time code
- May be added to **MCR1000** or **MCR5000**

Additional Option MCR-TCRA
Advanced Time Code
Reader Firmware Option
 Decode IRIG-A and IRIG-E waveforms



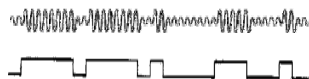
Masterclock's MCR-TCR (Time Code Reader) is an add-in module option for Master Clock Reference devices which reads and synchronizes to SMPTE or IRIG-B time code.

Affordable price and flexible order options make this a popular add-in for synchronizing to time code in broadcast, industry, power distribution and monitoring as well as for specialized military applications.

The TCR option automatically detects and locks to the incoming time code using an automatic gain control circuit. It is software controlled and locks to the most accurate time reference.

Advanced time code reader is an optional feature that enables the decoding of IRIG-A and IRIG-E waveforms.

Each MCR may be ordered with an MCR-TCR module option.



Optional Interconnects:
 BNC9 female adapter, Terminal Block adapter (MCR1000)
 BNC female, 3 POS Terminal Block (MCR5000)

Specifications		Time Codes Read			Additional Time Codes with Advanced TCR Option			
Format		SMPTE 12M	IRIG-B DCLS	IRIG-B AM	IRIG-A DCLS	IRIG-A AM	IRIG-E AM	IRIG-E DCLS
Rate		24,25, 30 fps NDF	1kHz, 1mS	1kHz, 1mS	10kHz, 0.1mS	10kHz, 0.1mS	100Hz, 10mS	100Hz, 10ms
Input Level Range		0.2 – 18Vpp 2 Vpp _{nom}	0.5 - 12 Vp 5Vp _{nom}	0.5 – 8 Vpp 5 Vpp _{nom}	0.5 - 12 Vp 5Vp _{nom}	0.5 – 8 Vpp 5 Vpp _{nom}	0.5 - 12 Vp 5Vp _{nom}	0.5 – 8 Vpp 5 Vpp _{nom}
Input Impedance kΩ		>10 kΩ			>10 kΩ		>10 kΩ	
Mark to Space Ratio		NA	NA	3.3:1	NA	3.3:1	NA	3.3:1
Automatic Gain Adjust		Over input level range			Over input level range		Over input level range	
Number of Inputs SE: Single Ended - Unbalanced Differential- Balanced		1SE 1DIFF	1SE 1DIFF	1SE 1DIFF	1SE 1DIFF	1SE 1DIFF	1SE 1DIFF	1SE 1DIFF
Type		NDF	DCLS	AM 1kHz	DCLS	AM 10kHz	DCLS	AM 100Hz
ENCODING		None, Leitch Date, SMPTE 309M	None, IEEE 1344 year, IRIG STD 200-04		None, IEEE 1344 year, IRIG STD 200-04		None, IEEE 1344 year, IRIG STD 200-04	
IRIG Coded Expression IRIG STD 200-04	0 BCD _{TOY} , CF,SBS	NA	B000	B120	A000	A130	E000	E110
	1 BCD _{TOY} , CF	NA	B001	B121	A001	A131	E001	E111
	2 BCD _{TOY}	NA	B002	B122	A002	A132	E002	E112
	3 BCD _{TOY} ,SBS	NA	B003	B123	A003	A133	E003	E113
	4 BCD _{TOY} , BCD _{Year} , CF,SBS (IEEE-1344 – 1995 encoding)	NA	B004	B124	A004	A134	E004	E114
	5 BCD _{TOY} , BCD _{Year} , CF	NA	B005	B125	A005	A135	E005	E115
	6 BCD _{TOY} , BCD _{Year}	NA	B006	B126	A006	A136	E006	E116
7 BCD _{TOY} , BCD _{Year} , SBS	NA	B007	B127	A007	A137	E007	E117	

Key Features

- Generates SMPTE & IRIG time codes
- Software controlled
- Optional Advanced Time Code Generation (see below)
- Locks to most accurate time source (GPS Receiver, Time Code Reader, NTP Client, HSO)
- May be added to **MCR1000** or **MCR5000**

Additional Option MCR-TCGA Advanced Time Code Generation Firmware

Provides IRIG-A and IRIG-E waveforms

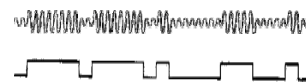


Masterclock's MCR-TCG (Time Code Generator) is an add-in module option for Master Clock Reference devices which provides generation of SMPTE or IRIG-B time code.

Affordable price and flexible order options make this a popular add-in for providing time code in broadcast, industry, power distribution and monitoring as well as for specialized military applications. The TCG option is software controlled and locks to the most accurate time reference.

Advanced time code generation is an optional feature to provide IRIG-A and IRIG-E waveform generation.

Each MCR may be ordered with an MCR-TCG module option.



Optional Interconnects:

BNC9 female adapter, Terminal Block adapter (MCR1000)

BNC female, 3 POS Terminal Block (MCR5000)

Specifications		Time Codes Generated			Additional Time Codes with Advanced TCG Option			
Format		SMPTE 12M	IRIG-B DCLS	IRIG-B AM	IRIG-A DCLS	IRIG-A AM	IRIG-E DCLS	IRIG-E AM
Rate		24,25, 30 fps NDF	1kHz, 1mS	1kHz, 1mS	10kHz, 0.1mS	10kHz, 0.1mS	100Hz, 10mS	100Hz, 10mS
Output Level @ 600Ω		4Vpp (5.2 dBm)	3 Vp (2.7 dBm)	4Vpp (5.2 dBm)	3 Vp (2.7 dBm)	4Vpp (5.2 dBm)	3 Vp (2.7 dBm)	4Vpp (5.2 dBm)
Output Level @ 50 Ω		3Vpp (13.5dBm)	1.75Vp (8.8dBm)	3Vpp (13.5dBm)	1.75Vp (8.8dBm)	3Vpp (13.5dBm)	1.75Vp (8.8dBm)	3Vpp (13.5dBm)
Mark to Space Ratio		NA	NA	3.3:1	NA	3.3:1	NA	3.3:1
Gain		1	1	1	1	1	1	1
Number of Outputs SE: Single Ended - Unbalanced Differential- Balanced (*excludes model MCR1000)		1SE *1DIFF	1SE *1DIFF	1SE *1DIFF	1SE *1DIFF	1SE *1DIFF	1SE *1DIFF	1SE *1DIFF
Type		NDF	DCLS	AM 1kHz	DCLS	AM 10kHz	DCLS	AM 100Hz
ENCODING		None, Leitch Date, SMPTE 309M	None or IEEE 1344 year or IRIG STD 200-04		None or IEEE 1344 year or IRIG STD 200-04		None or IEEE 1344 year or IRIG STD 200-04	
IRIG Coded Expression IRIG STD 200-04	0 BCD _{TOY} , CF,SBS	NA	B000	B120	A000	A130	E000	E110
	1 BCD _{TOY} , CF	NA	B001	B121	A001	A131	E001	E111
	2 BCD _{TOY}	NA	B002	B122	A002	A132	E002	E112
	3 BCD _{TOY} ,SBS	NA	B003	B123	A003	A133	E003	E113
	4 BCD _{TOY} , BCD _{Yearr} , CF,SBS (IEEE-1344 –1995 Encoding)	NA	B004	B124	A004	A134	E004	E114
	5 BCD _{TOY} , BCD _{Yearr} , CF	NA	B005	B125	A005	A135	E005	E115
	6 BCD _{TOY} , BCD _{Yearr}	NA	B006	B126	A006	A136	E006	E116
	7 BCD _{TOY} , BCD _{Yearr} , SBS	NA	B007	B127	A007	A137	E007	E117

Key Features

- Reads, synchronizes to, and outputs NMEA-0183 ASCII Messages
- NMEA code transmitted over Ethernet, RS-232 and USB ports
- Software controlled
- Supports multiple baud rates from 4,800 to 57,600
- May be added to MCR1000 and MCR5000

Masterclock's MCR-NMEA is an add-in firmware option for Master Clock Reference devices which reads and synchronizes or outputs NMEA-0183 messages.

The NMEA input option automatically detects and locks to the incoming NMEA-0183 messages. It is software controlled and locks to the most accurate time reference message available.



Specifications	Input/Output NMEA time stamped messages
Messages Supported	ZDA, GGA*, GLL*, GSA*, GSV*, RMC*, VTG*
Baud Rates Supported	4800, 9600, 19200, 38400, 57600
Data Bits	8, 7
Parity	None, Odd, Even
Stop bits	1, 2
Decode Rate	Up to once per second per message
Accuracy	Within 10 ms of receipt of first character of NMEA packet Overall accuracy to UTC top of second is dependent upon the NMEA output

*Requires MCR-GPS Module to output

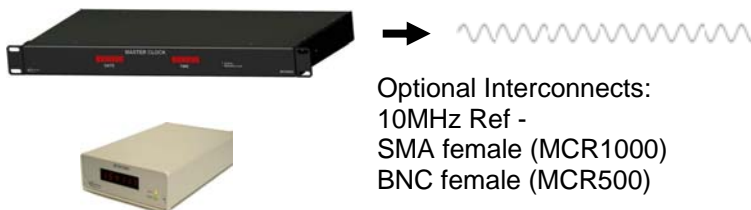
Key Features

- Available in three precision grade levels
- Typical holdover stability of 1 ppb/day, or better with OCXO
- Optional 10MHz Sine Wave Frequency Reference Output
- Locks to most accurate time source (GPS Receiver, Time Code Reader, NTP Client)
- May be added to **MCR1000** or **MCR5000**

Additional Option MCR-10MHz 10MHz Sine Wave Reference Output Option



MCR-HSO Module



Optional Interconnects:
10MHz Ref -
SMA female (MCR1000)
BNC female (MCR500)

Masterclock's MCR-HSO (High Stability Oscillator) is an add-in module option for Master Clock Reference devices which provides precision time and frequency for a wide range of applications. Affordable price and flexible order options make this a popular add-in for meeting critical time keeping during holdover (loss of primary reference such as GPS) as well as for specialized applications requiring a precise frequency reference.

The HSO option maintains excellent holdover stability of 1ppb/day or better using an OCXO. Various grade level options are available for specific applications.

An optional precision frequency 10MHz sine wave reference output is available as a source for laboratory use, or an RF reference such as cellular applications. When locked to GPS, the 10 MHz sine wave frequency will have the same long-term stability as an atomic clock. Each MCR may be ordered with an MCR-HSO module option. The MCR-HSO option is required for all 10 MHz sine wave references.

Specifications		High Stability Oscillator (HSO) Grade Option		
Freq = 10.000000 MHz Ref Waveform = Sine wave		1	3	4
Oscillator Type		VCTXO	OCVCXO	OCVCXO
Level (dBm) @ 50Ohms		7dBm ±2dBm	7dBm ±1dBm	8dBm ±1dBm
Freq Stability - Aging /day		TBD	±1.0 ppb/day (1x10E-9)	±0.1 ppb/day (1x10E-10)
Freq Stability - Aging/year		±1 ppm/year (1x10E ⁻⁶)	±0.3 ppm/year (3x10E ⁻⁷)	±0.1 ppm/year (1x10E ⁻⁷),
Short Term Stability (Allan Variance) 1 sec gate		TBD	≤ 1.0 e ⁻¹⁰	≤ 5.0 e ⁻¹¹
Time Drift per Year (max)		±3 sec	±0.3 sec	±0.15 sec
Temp Stability		±2.5ppm (-30 to 75°C)	±0.010 ppm (-5 to 50°C)	±0.050 ppm (0 to 50°C)
Gain		1	1	1
Number of Outputs – (10 MHz Sine wave Option)		1 (clipped sine wave)	1	1
Harmonic		NA	-30dBc Max	-30dBc Max
Phase Noise (dBc/Hz) @ 10MHz	1Hz	NA	NA	-95
	10Hz	NA	-120	-125
	100Hz	NA	-130	-140
	1kHz	NA	-140	-150
	10kHz	NA	-145	-150
	100kHz	NA	-145	-150

Key Features

- User programmable pulse width
- .0001 to 214,747 seconds (approximately 2.4 days), with 100 μ s resolution
- Edge triggered at top of second and synchronized to PPS
- One-shot, pulse train, or frequency generator modes with number of cycles up to 4 million
- Active high or active low pulse
- May be added to MCR1000 and MCR5000

Masterclock's MCR-PPO (Programmable Pulse Output) is an add-in module option for Master Clock Reference devices which provides a precision time referenced pulse output synchronized to the PPS of your MCR System.

The PPO option provides a pulse reference based on the high precision PPS of your Master Clock Reference.

Pulse widths from 100 μ s to over 2 days, with resolution of 50 μ s, are achievable. You may set your pulse to be active high or active low, triggered from the top of second. Pulses may be one shot, or you may use to produce pulse trains or as a frequency generator.

Each MCR may be ordered with an MCR-PPO module option.



MCR-PPO Module

Specifications	Programmable Pulse Output Option
Modes	Frequency generator, one-shot pulse generator, pulse train (programmable cycles)
Frequency Range	4.657 e-6 Hz to 200 kHz
Pulse Width Range	.0001 seconds to 214,747 seconds
Resolution	100 μ s
Programmable cycles	1 to 4,000,000 (0 cycles = continuous free running)
Accuracy	\pm 50 μ s of PPS edge
Pulse Type	Active High or Active Low (5V at 20mA)
Trigger	MCR System PPS

Display Modules

6 Digit Display Module - MCR1000

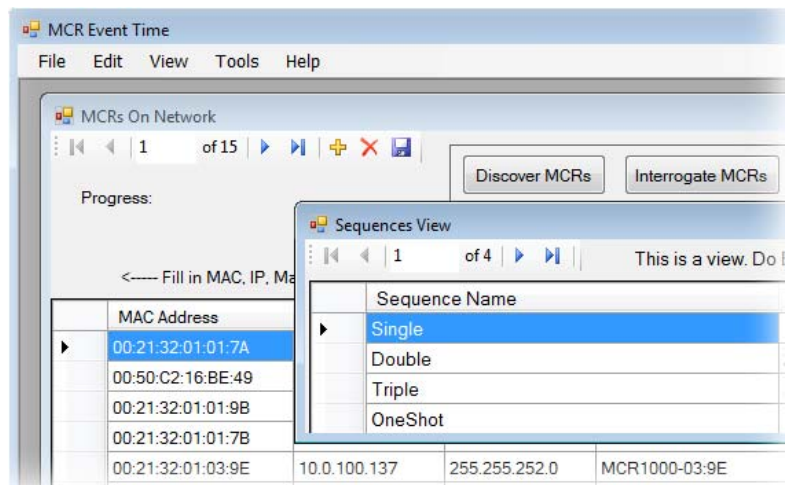
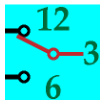


9 Digit Display Module - MCR1000



Event Time Software

MCR Event Time allows one to easily make a schedule for activating a relay¹ built into both of the MCR units. Up to 128 events can be scheduled per day. An MCR without this software is limited to one scheduled relay.



¹N/O contacts, 24V AC/DC, 250 mA max rating