



Networked Fast Clock Master Instruction Manual

MRB-FCM v1.1 Wired and Wireless

The MRB-FCM is a configurable digital fast clock designed to support timetable-based model railroad operations.

Key Features

- Real Time Clock with battery backup
- Fast clock ratio adjustable between 1.0:1 and 99.9:1
- Three configurable fast clock start times
- 12 and 24 hour time display formats
- MRBus-compatible
- Capable of driving secondary clock displays over wired or wireless networks

Basic Installation

Power Requirements

The MRB-FCM requires a stable 8-18V DC power supply capable of 3 watts (~0.4A at 8VDC, ~0.2A at 18VDC). For each slave that is also powered from the same supply, add another 3 watts of capacity. Power should be connected to J1 on the board (the pins marked VIN and GND are positive and negative respectively).

For example, a power supply for a single MRB-FCM and two MRB-FCS slave displays, you would need 9W. At 8 volts, that would be a minimum of a 1.2A supply. At 18 volts, the supply would only need to be able to source 0.5A.

Iowa Scaled Engineering sells a suitable 12 volt, 2 amp power supply as an accessory to the MRB-FCM.

MRBus Wiring (wired versions only)

Note: Wireless versions only need power wired to each node, and communicate via wireless MRBus packets transmitted over 802.15.4 radios operating in the 2.4GHz band. Wired versions need both power and data lines connected between each node. Wired and wireless versions can be combined using an MRBus Wireless Access Point (MRB-AP) to bridge packets from the wired to wireless networks.

The MRB-FCM is based on MRBus layout control bus technology (<http://www.mrbus.org/>), and can interoperate with other MRBus-based nodes (including MRB-FCS slave clock displays). To adhere with the physical specifications for a reliable MRBus segment, we highly recommend that you use Category 5 network cable (or better) to connect the nodes.



An MRB-FCM with optional faceplate and button kit, displaying fast time.

The recommended color code for Cat5 cable used to carry MRBus is (from the MRBus specification):

- 1 - +12VDC (White/Orange)
- 2 - GND (Orange)
- 3 - +12VDC (White/Green)
- 4 - MRBus:RS485-A (Blue)
- 5 - MRBus:RS485-B (White/Blue)
- 6 - GND (Green)
- 7 - DCC A (White/Brown)
- 8 - DCC B (Brown)

Each MRBus network also needs one set of biasing resistors to provide proper bus voltage levels. If your MRBus network doesn't already have a set of biasing resistors enabled, install the jumpers on JP4 and JP5 to enable the ones built into the MRB-FCM. If your bus already has biasing resistors, leave these jumpers off. Each segment must only have **one set** of biasing resistors enabled.

Switches

The MRB-FCM is designed around four soft keys that are defined by the text on the bottom line of the screen.

The FCM comes with four keys on the back, under the spaces where the four key functions will be displayed on the screen, that can be used to operate the device. However, most users will want to place forward-facing buttons under the screen for easy use and wire them into 5-pin header located on the right side of the board (J4). Switches should be momentary, normally open SPST (single pole, single throw) pushbuttons.

Each switch should be wired between one of the SWx pins and the COMMON pin. Looking at the display side of the MRB-FCM, SW4 corresponds to the switch on the rightmost switch and SW1 to the leftmost.

A switch kit and a machined faceplate are available from Iowa Scaled Engineering as an accessory kit for the FCM.

Initial Configuration

The MRB-FCM comes from Iowa Scaled preprogrammed with reasonable defaults, so for many users the only initial configuration needed will be the current date and time, as well as fast clock parameters appropriate for your layout. Press the "CONF" button and then follow the screen flows starting at Screen 2.0a to the Real Time and Real Date configuration menus.

Most users will want to start by setting the ratio between fast time and real time. Only you can determine what the proper fast clock ratio is for your layout, but as a suggestion, many operations want to simulate a 24-hour day within a 3-4 hour time period comprising an operating session. To figure out the ratio you want:

$$\text{Ratio} = (\text{Scale Time}) / (\text{Real Time})$$

So, if you want to simulate 10 hours in the space of 3 hours, you'd come up with a ratio of 10/3 or 3.3.

This is then set into the “Fast Ratio” menu screen (see screen 2.7).

Correspondingly, you will need to configure one or more of the three fast clock start times as well, as these are the options selectable when you press the “RST” (reset) key while in fast clock mode. These will most likely be the starting times for your operating sessions.

Finally, if you are connecting to an existing MRBus network, you'll need to make sure that the MRB-FCM's address is unique. To change, use the “Node Address” menu option.

Display Contrast

The MRB-FCM should be set to an acceptable LCD contrast when built, but if for some reason it ever becomes too dark or too light, use a small screwdriver to gently adjust the potentiometer R17 until the display contrast is back in an acceptable range.

Optional Temperature/Humidity Monitor

The MRB-FCM can be set up to monitor an MRBW-TH temperature and humidity sensor and display it alternating with the small date/time on the right side of line 3 on the main display. In order to read the sensor, the address of the remote sensor needs to be set in the “TH Address” menu option. Depending on how often the MRBW-TH is set to transmit, the timeout under “TH Timeout” may need to be adjusted so that the MRB-FCM doesn't stop displaying temperature and humidity readings.

Battery Replacement

If the MRB-FCM loses track of real time when unplugged, the backup battery may have come loose or gone dead. Replace with a new CR1220 3V lithium coin cell.

Advanced User Information

Packet Format and Configuration Values

For the latest reference to the MRB-FCM's packet formats and configuration EEPROM addresses, please see the Iowa Scaled Engineering website.

Open Design

Iowa Scaled Engineering is committed to creating open designs that users are free to build, modify, adapt, improve, and share with others.

Hardware

The design of the MRB-FCM hardware is open source hardware, and is made available under the term of the Creative Commons Attribution-Share Alike v3.0 license (a copy of the license is available from <http://creativecommons.org/licenses/by-sa/3.0/>)

Design files can be found on the Iowa Scaled Engineering website:

<http://www.iascaled.com/store/MRB-FCM>

Firmware

The official Iowa Scaled Engineering firmware for the MRB-FCM is free software: you can

redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation, either version 3 of the License, or (at your option) any later version. A copy of the GNU GPL can be found at <http://www.gnu.org/licenses/gpl.html>

New firmware can be flashed into the MRB-FCM through J3, a standard 6-pin Atmel AVR ISP (in-system programming) header.

Stable releases of firmware and source code can be found on the Iowa Scaled Engineering website: <http://www.iascaled.com/store/MRB-FCM>

The latest firmware source can also be obtained from our Subversion version control archive - you'll need both the mrb-fcm project and the mrbus/mrbee core library pieces. They can be obtained from:

Fast Clock Master:

`svn://mrbus.org/mrbus/trunk/mrb-fcm`

Core libraries:

`svn://mrbus.org/mrbus/trunk/mrbus`

`svn://mrbus.org/mrbus/trunk/mrbee`

Screen 1.0: Main Screen – Real Time Clock Mode

12 : 34	AM
FC:1200A	REAL
11 Nov	2012
FAST	CONF

Element	Description
12 : 34	The current real time, in hour/minute form. If 24 hour real time is selected, this will display with the leading zero. If 12 hour real time is selected, the leading zero will be suppressed.
11 Nov 2012	The current real day, month, and year.
FC:1200A	The current state of the fast clock. This will display FC: if the clock will immediately resume counting upon entry into Fast Clock Mode(FCM), and FH: if the clock will go into hold upon entering FCM.
AM	If 24 hour real time is selected, this will show “24”. In 12 hour real time mode, this will show AM or PM as appropriate.
REAL	An indicator that the clock is currently in Real Time Mode (RTM).
FAST	Soft key 1 will enter into Fast Clock Mode – see Screen 1.1
CONF	Soft key 4 will enter the Configuration Menu – see Screen 2.0

Screen 1.1: Main Screen – Fast Clock Mode

12 : 34	AM
	FAST
12.5:1	12:34:56AM
REAL HOLD	RST CONF

Element	Description
12 : 34	The current fast time, in hour/minute form. If 24 hour fast time is selected, this will display with the leading zero. If 12 hour fast time is selected, the leading zero will be suppressed. In hold mode, the display will show “HOLD”
12 : 34 : 56AM	The current real time, in hours/minutes/seconds and an AM/PM indicator if the real time clock is set up for 12 hour mode.
12 . 5 : 1	The current fast time ratio, expressed in units of fast time that will pass during 1 unit of real time. (eg, 12.5 seconds will elapse for every real second in this

	example.)
REAL	Soft key 1 will enter into Real Time Clock Mode – see Screen 1.0
HOLD	Soft key 2 will toggle between the fast clock time advancing at the programmed ratio and the fast clock being paused - “hold” mode. If the clock is running, it will display “HOLD”, and if the clock is paused, it will display “RUN”, reflecting the mode it will toggle into.
RST	Soft key 3 will reset the fast clock to the configured start time. See screen 1.2 for the reset confirmation screen, and see screen 2.7 for configuring the fast clock start time.
CONF	Soft key 4 will enter the Configuration Menu – see screen 2.0a

Screen 1.2: Fast Clock Reset Confirmation

!! CONFIRM !!
Reset Fast Clock
to Which Start Time?
0800 1200 1800 CNCL

Element	Description
0800	Soft key 1 will reset the fast clock time to the first configured starting time (see screen 2.7) and return to the Fast Clock Mode main screen (screen 1.1). The time displayed will always be in 24h format so that it fits above the button.
1200	Soft key 3 will reset the fast clock time to the second configured starting time (see screen 2.7) and return to the Fast Clock Mode main screen (screen 1.1). The time displayed will always be in 24h format so that it fits above the button.
1800	Soft key 3 will reset the fast clock time to the third configured starting time (see screen 2.7) and return to the Fast Clock Mode main screen (screen 1.1). The time displayed will always be in 24h format so that it fits above the button.
CNCL	Soft key 4 will return to the Fast Clock Mode main screen (screen 1.1) without affecting the current fast time.

Screen 2.0a: Main Configuration Menu Screen 1

```
> Real 12/24
  Real Time
  Real Date
  UP  DOWN SLCT BACK
```

Element	Description
>	A cursor indicating the current menu selection
Real 12/24	Configure real time to be in 12 or 24 hour mode – see screen 2.1
Real Time	Set current real time – see screen 2.2
Real Date	Set current real date – see screen 2.4
UP	Soft key 1 – will move the cursor up the menu structure. Soft key will be disabled if at the top of the configuration menu list.
DOWN	Soft key 2 – will move the cursor down the menu structure. If the cursor is moved past the bottom of the displayed list, the configuration menu will progress to the second config screen 2.0b.
SLCT	Soft key 3 – will select the current configuration option.
BACK	Soft key 4 – will return to the main screen in either real time clock mode (screen 1.0) or fast clock mode (screen 1.1), depending on which was used to enter the configuration menu.

Screen 2.0b: Main Configuration Menu Screen 2

```
> Fast 12/24
  Fast Ratio
  Fast Start Hold
  UP  DOWN SLCT BACK
```

Element	Description
>	A cursor indicating the current menu selection
Fast 12/24	Configure fast time to be in 12 or 24 hour mode – see screen 2.6
Fast Ratio	Set fast clock ratio of fast time to real elapsed time – see screen 2.7
Fast Start Hold	Configure if the fast clock will always be set to “hold” when fast clock mode is entered – see screen 2.11
UP	Soft key 1 – will move the cursor up the menu structure. If the cursor is

	moved up beyond the top of the list, it will go back to configuration screen 2.0a.
DOWN	Soft key 2 – will move the cursor down the menu structure. If it passes the bottom of the displayed list, the configuration menu will progress to screen 2.0c.
SLCT	Soft key 3 – will select the current configuration option.
BACK	Soft key 4 – will return to the main screen in either real time clock mode (screen 1.0) or fast clock mode (screen 1.1), depending on which was used to enter the configuration menu.

Screen 2.0c: Main Configuration Menu Screen 3

```

> Fast Start Time 1
  Fast Start Time 2
  Fast Start Time 3
UP  DOWN SLCT BACK

```

Element	Description
>	A cursor indicating the current menu selection
Fast Start Time 1	Set the first start time at which the fast clock can be reset to – typically whatever hour/minute of the fast day your operating session will start on. Fast Start Time 1 is what the clock will default to using when first powered up. See screen 2.9 for time setup. Will appear on soft key 1 when a reset is requested (screen 1.2).
Fast Start Time 2	Set the second start time at which the fast clock can be reset to – typically whatever hour/minute of the fast day your operating session will start on. See screen 2.9 for time setup. Will appear on soft key 2 when a reset is requested (screen 1.2).
Fast Start Time 3	Set the third start time at which the fast clock can be reset to – typically whatever hour/minute of the fast day your operating session will start on. See screen 2.9 for time setup. Will appear on soft key 3 when a reset is requested (screen 1.2).
UP	Soft key 1 – will move the cursor up the menu structure. If the cursor is moved up beyond the top of the list, it will go back to configuration screen 2.0b.
DOWN	Soft key 2 – will move the cursor down the menu structure. If it passes the bottom of the displayed list, the configuration menu will progress to screen 2.0d.
SLCT	Soft key 3 – will select the current configuration option.
BACK	Soft key 4 – will return to the main screen in either real time clock mode

(screen 1.0) or fast clock mode (screen 1.1), depending on which was used to enter the configuration menu.

Screen 2.0d: Main Configuration Menu Screen 4

```
> Time Pkt Interval
  Node Address
  TH Address
  UP  DOWN SLCT BACK
```

Element	Description
>	A cursor indicating the current menu selection
Time Pkt Interval	Configure how often the master clock will send synchronization packets to slave clocks. See screen 2.12
Node Address	Configure the MRBus address of the fast clock master. See screen 2.14
TH Address	Configure the address of a MRBW-TH temperature/humidity sensor. See screen 2.17
UP	Soft key 1 – will move the cursor up the menu structure. If the cursor is moved up beyond the top of the list, it will go back to configuration screen 2.0c.
DOWN	Soft key 2 – will move the cursor down the menu structure. If on the last item, the soft key will be disabled.
SLCT	Soft key 3 – will select the current configuration option.
BACK	Soft key 4 – will return to the main screen in either real time clock mode (screen 1.0) or fast clock mode (screen 1.1), depending on which was used to enter the configuration menu.

Screen 2.0e: Main Configuration Menu Screen 5

```
> TH Timeout
  Temperature Units
  Diagnostics
  UP  DOWN SLCT BACK
```

Element	Description
>	A cursor indicating the current menu selection
TH Timeout	Configure the maximum time between two MRBW-TH packets before the

	sensor is considered to have “timed out”. See screen 2.19
Temperature Units	Configure which unit s (degrees Fahrenheit or Celsius) that temperatures from an MRBW-TH will be displayed in. See screen 2.21
Diagnostics	View diagnostic information about the fast clock master node – see screen 2.16.
UP	Soft key 1 – will move the cursor up the menu structure. If the cursor is moved up beyond the top of the list, it will go back to configuration screen 2.0c.
DOWN	Soft key 2 – will move the cursor down the menu structure. If on the last item, the soft key will be disabled.
SLCT	Soft key 3 – will select the current configuration option.
BACK	Soft key 4 – will return to the main screen in either real time clock mode (screen 1.0) or fast clock mode (screen 1.1), depending on which was used to enter the configuration menu.

Screen 2.1: Real Time 12/24h Configuration Screen

```

Real Time 12/24H:
[*] 12H (AM/PM)
[ ] 24H (0000h)
12hr 24hr SAVE CNCL
  
```

Element	Description
*	A cursor indicating the current selection
12H (AM/PM)	Configure real time to be displayed in 12 hour, AM/PM time.
24H (0000h)	Configure real time to be displayed in 24 hour time.
12hr	Soft key 1 – selects 12 hour time.
24hr	Soft key 2 – selects 24 hour time.
SAVE	Soft key 3 – saves real time format selection and returns to configuration screen 2.0a.
CNCL	Soft key 4 – returns to configuration screen 2.0a without saving real time format change.

Screen 2.2: Real Time Set Screen

```

Current Real Time:
12:34:56 AM
^^
++  --  >>  GO
  
```

Element	Description
12:34:56	The current real time, displayed as 12 or 24 hour time as selected in screen 2.1. (In 24h time, the AM/PM indicator will not display. In 12h mode, AM/PM cannot be directly adjusted, but advancing the hours over midnight or noon will cause the transition.)
^^	A cursor indicating which part of real time is subject to adjustment by soft keys 1 and 2.
++	Soft key 1 – increments the currently selected part of the time.
--	Soft key 2 – decrements the currently selected part of the time.
>>	Soft key 3 – moves the cursor to the next component of time to the right (hours move to minutes move to seconds, which then wraps around to hours)

G0	Soft key 4 – advances to screen 2.3 which confirms the time being set.
----	--

Screen 2.3: Real Time Set Confirmation Screen

Current Real Time: 12:34:56 AM
BACK SAVE CNCL

Element	Description
12:34:56	The current real time to be set as configured in screen 2.2, displayed as 12 or 24 hour time as selected in screen 2.1. (In 24h time, the AM/PM indicator will not display.)
BACK	Soft key 1 – returns to screen 2.2, so that the real time to be set can be changed.
SAVE	Soft key 3 – saves the displayed real time to the internal real time clock.
CNCL	Soft key 4 – cancels changing the real time and returns to the main configuration menu (screen 2.0a).

Screen 2.4: Real Date Configuration Screen

Current Real Date: 11 Nov 2012 ^^
++ -- >> G0

Element	Description
^^	A cursor indicating which part of real time clock date is subject to adjustment by soft keys 1 and 2.
11 Nov 2012	The current real date
++	Soft key 1 – increments the currently selected part of the date.
--	Soft key 2 – decrements the currently selected part of the date.
>>	Soft key 3 – moves the cursor to the next component of date to the right (day moves to month moves to year, which then wraps around to day)
G0	Soft key 4 – advances to screen 2.5 which confirms the real time clock date being set.

Screen 2.5: Real Date Confirmation Screen

Current Real Date:
11 Nov 2012

BACK SAVE CNCL

Element	Description
11 Nov 2012	The current date, as selected in screen 2.4
BACK	Soft key 1 – returns to screen 2.4, so that the date to be set can be changed.
SAVE	Soft key 3 – saves the displayed date to onboard real time clock
CNCL	Soft key 4 – cancels changing the date and returns to the main configuration menu (screen 2.0a).

Screen 2.6: Fast Time 12/24h Configuration Screen

Fast Time 12/24H:
[*] 12H (AM/PM)
[] 24H (0000h)
12hr 24hr SAVE CNCL

Element	Description
*	A cursor indicating the current selection
12H (AM/PM)	Configure fast time to be displayed in 12 hour, AM/PM time.
24H (0000h)	Configure fast time to be displayed in 24 hour time.
12hr	Soft key 1 – selects 12 hour time.
24hr	Soft key 2 – selects 24 hour time.
SAVE	Soft key 3 – saves fast time format selection and returns to configuration screen 2.0b.
CNCL	Soft key 4 – returns to configuration screen 2.0b without saving fast time format change.

Screen 2.7: Fast Clock Ratio Configuration Screen

```
Fast Clock Ratio:
12.5:1
^^
++  --  >>  G0
```

Element	Description
12.5:1	The ratio between how quickly fast time passes and how quickly real time passes. As an example, 4.0:1 would yield the passage of 24 hours of fast time in 6 hours.
^^	A cursor indicating which part of the ratio is subject to adjustment by soft keys 1 and 2.
++	Soft key 1 – increments the currently selected part of the ratio.
--	Soft key 2 – decrements the currently selected part of the ratio.
>>	Soft key 3 – moves the cursor to the next component of the ratio to the right (integer portion or tenths), or wraps around if already on tenths.
G0	Soft key 4 – advances to screen 2.8 which confirms the ratio being set

Screen 2.8: Fast Clock Ratio Confirmation Screen

```
Fast Clock Ratio:
12.5:1

BACK      SAVE  CNCL
```

Element	Description
12.5:1	The ratio between fast time and real time as selected in screen 2.7.
BACK	Soft key 1 – returns to screen 2.7, so that the fast clock ratio to be set can be changed.
SAVE	Soft key 3 – saves the displayed fast clock ratio to configuration memory
CNCL	Soft key 4 – cancels changing the fast clock ratio and returns to the main configuration menu (screen 2.0b).

Screen 2.9: Fast Start Time Set Screen

```

Fast Start Time X:
12:34:56 AM
^^
++   --   >>   GO
    
```

Element	Description
Fast Start Time X:	X will be 1, 2, or 3, corresponding to which fast clock starting time is being set. See screen 1.2 for where fast clock start times can be selected during a reset, and screen 2.0c for how each start time configuration is reached.
12:34:56	The desired start time for the fast clock, displayed as 12 or 24 hour time as selected in screen 2.6. (In 24h time, the AM/PM indicator will not display. In 12h mode, AM/PM cannot be directly adjusted, but advancing the hours over midnight or noon will cause the transition.)
^^	A cursor indicating which part of fast start time is subject to adjustment by soft keys 1 and 2.
++	Soft key 1 – increments the currently selected part of the time.
--	Soft key 2 – decrements the currently selected part of the time.
>>	Soft key 3 – moves the cursor to the next component of time to the right (hours move to minutes move to seconds, which then wraps around to hours)
GO	Soft key 4 – advances to screen 2.10 which confirms the fast start time being set.

Screen 2.10: Fast Start Time Confirmation Screen

Fast Start Time X: 12:34:56 AM
BACK SAVE CNCL

Element	Description
Fast Start Time X:	X will be 1, 2, or 3, corresponding to which fast clock starting time is being set. See screen 1.2 for where fast clock start times can be selected during a reset, and screen 2.0c for how each start time configuration is reached.
12:34:56	The fast clock start time to be set as configured in screen 2.6, displayed as 12 or 24 hour time as selected in screen 2.6. (In 24h time, the AM/PM indicator will not display.)
BACK	Soft key 1 – returns to screen 2.9, so that the fast clock start time to be set can be changed.
SAVE	Soft key 3 – saves the displayed fast clock start time to configuration memory
CNCL	Soft key 4 – cancels changing the fast clock start time and returns to the main configuration menu (screen 2.0b).

Screen 2.11: Fast Clock Hold Configuration Screen

Fast Start Mode:
[*] RUN (12:34A)
[] HOLD
RUN HOLD SAVE CNCL

Element	Description
*	A cursor indicating the current selection
[] RUN	Configure fast time to start counting immediately when fast clock mode is entered. As a convenience, the configured fast clock starting time is shown after “Run”.
[] HOLD	Configure fast time to immediately go to “hold” when fast clock mode is entered.
RUN	Soft key 1 – selects run mode.
HOLD	Soft key 2 – selects hold mode.
SAVE	Soft key 3 – saves fast time run/hold mode selection and returns to configuration screen 2.0c.
CNCL	Soft key 4 – returns to configuration screen 2.0c without saving fast time run/hold mode change.

Screen 2.12: Time Packet Interval Configuration Screen

```

Time Pkt Interval:
001.2 sec
^
++   --   >>   GO
    
```

Element	Description
001.2 sec	The desired time between broadcasting time packets on the network, expressed in seconds. For most applications, 1-3 seconds is probably optimal (meaning a setting of 1.0-3.0).
^^	A cursor indicating which digit of the time is subject to adjustment by soft keys 1 and 2.
++	Soft key 1 – increments the currently selected part of the time.
--	Soft key 2 – decrements the currently selected part of the time.
>>	Soft key 3 – moves the cursor to the next component of time to the right, or will wrap back around if already on the rightmost digit
GO	Soft key 4 – advances to screen 2.13 which confirms the packet interval time being set.

Screen 2.13: Time Packet Interval Confirmation Screen

```

Time Pkt Interval:
001.2 sec

BACK      SAVE  CNCL
    
```

Element	Description
001.2 sec	The desired time between broadcasting time packets on the network, expressed in seconds. For most applications, 1-3 seconds is probably optimal (meaning a setting of 1.0-3.0).
BACK	Soft key 1 – returns to screen 2.12, so that the fast clock start time to be set can be changed.
SAVE	Soft key 3 – saves the displayed fast clock start time to configuration memory and returns to the main configuration menu (screen 2.0c)
CNCL	Soft key 4 – cancels changing the fast clock start time and returns to the main configuration menu (screen 2.0c).

Screen 2.14: Fast Clock Master Node Address Configuration Screen

```
Fast Clock Addr:
0x1A
  ^
++   --   >>   G0
```

Element	Description
0x1A	The hexadecimal network address of the fast clock master node. All MRBus nodes must have a unique address. For pure fast clock applications, changing this should not be needed.
^^	A cursor indicating which digit of the address is subject to adjustment by soft keys 1 and 2.
++	Soft key 1 – increments the currently selected part of the address.
--	Soft key 2 – decrements the currently selected part of the address.
>>	Soft key 3 – moves the cursor to the next digit of address to the right
G0	Soft key 4 – advances to screen 2.15 which confirms the network address.

Screen 2.15: Fast Clock Master Node Address Confirmation Screen

```
Fast Clock Addr:
0x1A

BACK          SAVE  CNCL
```

Element	Description
0x1A	The hexadecimal network address of the fast clock master node to be set.
BACK	Soft key 1 – returns to screen 2.14, so that the node address to be set can be changed.
SAVE	Soft key 3 – saves the displayed fast clock node address to configuration memory and returns to the main configuration menu (screen 2.0c)
CNCL	Soft key 4 – cancels changing the fast clock node address and returns to the main configuration menu (screen 2.0c).

Screen 2.16: Diagnostics Screen

```

Diagnostics: 122kl/s
Bus:11.6V   Addr:0x1A
TH : 3.1V
RFSH                BACK

```

Element	Description
Bus:11.6V	The current power supply voltage for the fast clock master node. Will read roughly 0.5V lower than the actual bus voltage, as the sensing is done after the protection diode on the front end.
Addr:0x1A	The MRBus network address of the fast clock master node.
122kl/s	The speed at which the main loop is executing, in thousands of loops per second. This is almost meaningless to an end user, but is handy for debugging slow reponse problems.
TH : 3.2V	If a MRBW-TH temperature/humidity monitor is configured and the fast clock has received a packet within the timeout period, the supply voltage for the MRBW-TH will be displayed here. This is useful for checking the battery voltage on wireless, battery powered temperature/humidity nodes.
RFSH	Soft key 1 – Forces immediate refresh of the values displayed on the diagnostics screen. The screen will refresh itself every second on its own.
CNCL	Soft key 4 – cancels out of diagnostic mode and returns to the main configuration menu (screen 2.0e).

Screen 2.17: Temperature/Humidity Node Address Configuration Screen

```
Temp/Humidity Addr:
0x20
 ^
++   --   >>   G0
```

Element	Description
0x20	The MRBus address of the MRBW-TH node to be monitored. Setting this to 0x00 will cause the display to show “”T/H Off” and disable any display of temperature and humidity.
^	A cursor indicating which digit of the address is subject to adjustment by soft keys 1 and 2.
++	Soft key 1 – increments the currently selected part of the address.
--	Soft key 2 – decrements the currently selected part of the address.
>>	Soft key 3 – moves the cursor to the next component of time to the right, or will wrap back around if already on the rightmost digit
G0	Soft key 4 – advances to screen 2.18 which confirms the TH address to be monitored.

Screen 2.18: Temperature/Humidity Node Address Confirmation Screen

```
Temp/Humidity Addr:
0x20

BACK      SAVE  CNCL
```

Element	Description
0x20	The MRBus address of the MRBW-TH node to be monitored. Setting this to 0x00 will cause the display to show “”T/H Off” and disable any display of temperature and humidity.
BACK	Soft key 1 – returns to screen 2.17, so that the MRBW-TH source address can be changed.
SAVE	Soft key 3 – saves the displayed temperature/humidity source address to configuration memory and returns to the main configuration menu (screen 2.0d)
CNCL	Soft key 4 – cancels changing the temperature/humidity source address and returns to the main configuration menu (screen 2.0d).

Screen 2.19: Temperature/Humidity Timeout Configuration Screen

```
Temp/Hum Timeout:
0012 sec
^
++   --   >>   GO
```

Element	Description
0012 sec	The maximum amount of allowed time between received packets from the configured MRBW-TH node. If a valid 'S' packet from the TH node is not configured within this interval, the fast clock will stop displaying temperature/humidity until another packet is received.
^	A cursor indicating which digit of the time is subject to adjustment by soft keys 1 and 2.
++	Soft key 1 – increments the currently selected part of the time.
--	Soft key 2 – decrements the currently selected part of the time.
>>	Soft key 3 – moves the cursor to the next component of time to the right, or will wrap back around if already on the rightmost digit
GO	Soft key 4 – advances to screen 2.20 which confirms the timeout being set.

Screen 2.20: Temperature/Humidity Timeout Confirmation Screen

```
Temp/Hum Timeout:
0012 sec

BACK      SAVE CNCL
```

Element	Description
0012 sec	The maximum amount of allowed time between received packets from the configured MRBW-TH node. If a valid 'S' packet from the TH node is not configured within this interval, the fast clock will stop displaying temperature/humidity until another packet is received.
BACK	Soft key 1 – returns to screen 2.19, so that the temperature/humidity packet time to be set can be changed.
SAVE	Soft key 3 – saves the displayed temperature/humidity timeout to configuration memory and returns to the main configuration menu (screen 2.0e)

CNCL	Soft key 4 – cancels changing the temperature/humidity timeout and returns to the main configuration menu (screen 2.0e).
------	--

Screen 2.21: Temperature Units Configuration Screen

Temperature Units: [*] Degrees F [] Degrees C F C SAVE CNCL

Element	Description
*	A cursor indicating the current selection
Degrees F	Configure temperature to be displayed in degrees Fahrenheit
Degrees C	Configure temperature to be displayed in degrees Celsius
F	Soft key 1 – selects degrees Fahrenheit
C	Soft key 2 – selects degrees Celsius
SAVE	Soft key 3 – saves real time format selection and returns to configuration screen 2.0e.
CNCL	Soft key 4 – returns to configuration screen 2.0e without saving real time format change.