LocoNet® Fast Clock
User's Guide

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LOGIC RAIL™
TECHNOLOGIES

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1.   Introduction

Thank you for purchasing a *Logic Rail Technologies* product. The LNFC provides remote fast clock display capability and works in conjunction with the network fast clock found on Digitrax command stations such as the DCS100. The LNFC has the following features:

- Large (0.8"), easy-to-read, red LED digits
- Local 12 or 24 hour time format
- Local alarm
- 4 independent Event Triggers (see section 1.3)
- Adjustable brightness level
- Ability to change the network time and fast rate
- Two LocoNet jacks for connecting to other LNFCs or other LocoNet products
- Pre-mounted fascia plate ready for easy installation; can be installed in a standard Radio Shack project box
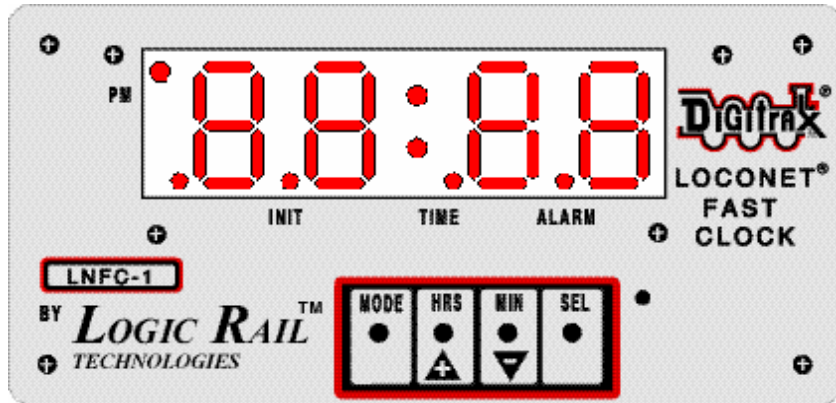
1.1   Package Contents

This product consists of the following items:

- Fast clock display module with pre-mounted fascia plate
- 120VAC wall transformer
- 3' LocoNet® cable
- User's Guide

1.2   Theory of Operation

When power is first applied the LNFC-1 will beep and turn on all LED segments. This is illustrated below.

The LNFC will then enter the *current time* mode or *idle* mode depending upon whether or not the LocoNet is active. Each LNFC keeps its own time internally but relies upon periodic LocoNet fast clock messages for synchronization and new time or fast rate settings.

The LNFC has a variety of attributes or features that you can configure or select. These include:
- Display brightness
- Hour format (12 or 24; DT100 throttles only support the 24 hour format)
- Local alarm
- Local alarm behavior (on/off, flashing colon or alarm indicator)
- Flashing colon when clock is running
- Initial/default (i.e. power-up) time
- Event Triggers (see section 1.3)

All of these attributes are local to the LNFC. You can configure them at any time (except when the LNFC is in the idle mode) using the front panel keys and the display. The configuration settings for the LNFC are kept in a non-volatile (i.e. doesn't forget when power is removed!) storage device on the module. No batteries to replace!

1.3   Event Trigger Feature

Event Triggers can be used to turn layout accessories (e.g. building lights, animation, turnouts) on or off at fast clock times that you define. The LNFC supports this capability when used in conjunction with DCC Accessory Decoders (e.g. Digitrax' DS54, CVP's AD4, etc). The LNFC sends accessory decoder commands via LocoNet. The Digitrax command station then translates these commands into the appropriate DCC packets. As such it is absolutely **NOT** necessary for the accessory decoder to be LocoNet-capable.

Each LNFC has one Event Trigger associated with the local alarm and three Event Triggers with programmable Start & End times. There are two types of Event Triggers: **duration** and **one-shot**.

A **duration** trigger has a **start** time and an **end** time. When the **start** time is reached an accessory decoder command is sent to the switch address you select along with your selection for setting the decoder switch state to closed or thrown. When the **end** time is reached another accessory decoder command is sent to the SAME switch address but this time the decoder switch is set to the opposite state. For example, assume the Event Trigger start time is programmed to 6:30pm, the end time is programmed to 9:05pm, and the switch address is programmed to 8 with the switch state set to closed. Then, when the time reaches 6:30pm an accessory decoder command is sent to switch address 8 with the switch state set to closed. Then, when the time reaches 9:05pm an accessory decoder command is sent to switch address 8 with the switch state set to thrown. This type of trigger is most likely to be used to turn lights on and off.

A **one-shot** trigger means that when the associated time is met a single accessory decoder command is sent (i.e. the accessory decoder switch state is set to either closed or thrown according to your selection). This type of trigger could be used in conjunction with the accessory decoder's output duration CV to create a "pulsed" output. This could be used to momentarily activate a motor or solenoid.

The local alarm event trigger can only be a one-shot trigger. The other three Event Triggers can be independently set to be a one-shot type or a duration type. For these triggers, setting the end time equal to the start time will define a one-shot trigger.

2.   Display Modes

The LNFC display can be in one of three modes: *current time*, *edit*, or *idle*. Most of the time the display will be showing the current time. The *edit* mode is used to change clock and display parameters such as fast rate, alarm time, brightness, etc. The *idle* mode is entered when the LNFC detects that the LocoNet has become idle; the display will look like this:
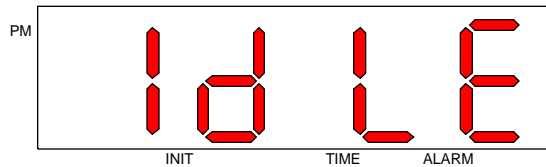
When the LNFC is in the idle mode the current time will be frozen and it will not respond to key activity. The LNFC will exit the idle mode when the LocoNet is active again.

3.   Quick Start Guide

The LNFC is ready for installation. You should be able to have it up and running on the LocoNet in a matter of seconds (*real* time seconds, not *fast* time seconds!). Follow these simple steps:

1. Plug either end of the enclosed LocoNet cable into either jack on the back of the LNFC. Make sure you hear the connector "click." **NOTE:** Leave the other end of the LocoNet cable unconnected at this point!
2. Insert the small round plug end of the enclosed wall transformer into the mating connector on the back of the LNFC.
3. Plug the wall transformer into any available AC outlet. **Caution:** children should not be allowed to do this without adult supervision! Electrocution and death could occur!
4. The LNFC display should light up and the LNFC should beep twice. The display should show "IdLE" as previously illustrated. If this is not the case refer to Section 11 on troubleshooting; do not proceed to the next step here.
5. Plug the remaining end of the enclosed LocoNet cable into any available LocoNet jack on your layout. The display will change from the idle mode to the current time mode provided the LocoNet is not idle.

6. If there is already another LNFC connected to the LocoNet then stop here and refer to Section 6.1 on establishing the LocoNet clock master. If this is the first/only LNFC then proceed to the next step.
7. The LNFC and any fast clock-aware devices (e.g. DT100 throttles) will be synchronized and will display the current time.

4.   Choosing a Fast Rate

There is no right or wrong fast rate value to use. It can vary from scale to scale and user to user. If you actually want to operate your railroad "by the clock", some points to keep in mind are:

- the distance between stations or towns; the longer the distance, the lower the fast rate can be.
- switching time; it doesn't make sense to choose a high fast rate if your switching crew is totally overwhelmed by the clock and they can't enjoy their work!
- train speeds; the faster you run your trains, the faster you'll need to run the clock in order to make distances appear longer.
- average operating session length; if you expect to complete an entire day's work in a three hour operating session, then you'd better choose a fast rate of around 8.

For a detailed discussion of fast clocks and their usage consult the book **How to Operate Your Model Railroad** by Bruce A. Chubb. You may want to try operating your layout a few times with different fast rates to assess which is most fitting. Typically, most modelers choose a fast rate between 4 and 12. Although the LNFC supports fast rates up to 100 it is hard to envision someone using one that high!

5.   Edit Mode

The edit mode uses the LNFC's four front panel keys as well as the display. The key functions are summarized as follows:

MODE: Press this key to enter the edit mode. Press it again at any time to return to the current time mode.

+/HRS: Press this key to advance ahead to the next menu choice in edit mode. When changing the fast rate, brightness, event trigger enable, or option switch settings this key will increment the value. When entering a time (clock, initial/default, alarm, or event start/end) pressing this key will advance the Hours value. When entering an accessory decoder switch address pressing this key will increase the thousands and hundreds value.

-/MIN: Press this key to retreat back to the previous menu choice in edit mode. When changing the fast rate, brightness, event trigger enable, or option switch settings this key will decrement the value. When entering a time (clock, initial/default, alarm, or event start/end) pressing this key will advance the Minutes value. When entering an accessory decoder switch address pressing this key will increase the tens and units value.

SEL: Press this key to select the menu item currently displayed. When editing parameters pressing this key will accept the change.

When you press the **MODE** key for the first time the display will change from the current time to "cLoc". Pressing the **+/HRS** key will move to the next menu item; pressing the **-/MIN** key will move to the previous menu item. Pressing the **MODE** key again at any time will return the display to the current time. Please note that while in the edit mode the clock is still running (if the fast rate is not 0 and the clock is not paused). The menu items are presented in the following order:

Display	Parameter to Edit
cLoc	Current Time
rAtE	Fast Rate
ALAr	Alarm Time
Etr	Event Trigger
brit	Brightness
Init	Initial/Default Time
Co X.Y	Code Revision
oPtn	Option Switch
rSt	Reset

5.1   Current Time ("cLoc")
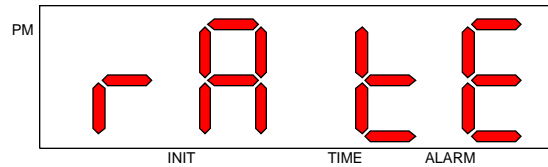
PM

    cLoc

INIT   TIME   ALARM
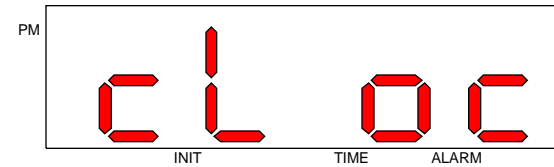
The current time can be changed by pressing the **SEL** key when the display shows "cLoc". The current time will be shown and the time indicator will be illuminated. The PM indicator will only be illuminated if you've chosen the 12 hour time format and the current time is PM! For example, if the current time is 20:35 (24 hour format) the display will look like this:
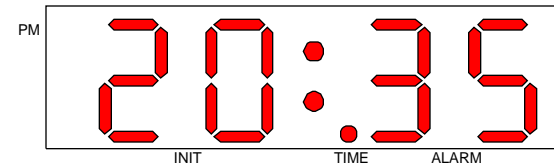
PM

    20:35

INIT   TIME   ALARM

Change the hours by pressing the +/**HRS** key; the hours will increment from the current setting up to 23 (or 11pm) and then "wrap-around" to 00 (or 12am). Change the minutes by pressing the **-/MIN** key; the minutes will increment from the current setting up to 59 and then "wrap-around" to 00. If you change your mind and don't wish to change the current time, simply press the **MODE** key; the display will return to the current time (adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the new time press the **SEL** key; the display will then show "cLoc" again. At this point pressing the **MODE** key will change the display to the new current time.

5.2   Fast Rate ("rAtE")

```
PM   ┌─────────────────────────┐
     │                         │
     │    r A t E              │
     │                         │
     └─────────────────────────┘
        INIT      TIME    ALARM
```

The fast rate can be changed by pressing the **SEL** key when the display shows "rAtE". The current fast rate will be shown. For example, if the current fast rate is 8:1 the display will show:

```
PM   ┌─────────────────────────┐
     │                         │
     │    F r    0 8           │
     │                         │
     └─────────────────────────┘
        INIT      TIME    ALARM
```

You can increase the fast rate by pressing the **+/HRS** key; the fast rate will increment from the current setting up to A0 (equals 100) and then "wrap-around" to 00 (clock stopped). You can decrease the fast rate by pressing the **-/MIN** key; the fast rate will decrement from the current setting down to 00 and then "wrap-around" to A0. If you change your mind and don't wish to change the fast rate, simply press the **MODE** key; the display will return to the current time (adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the new fast rate press the **SEL** key; the display will then show "rAtE" again. The new fast rate will be in effect and stored in non-volatile memory as well. At this point pressing the **MODE** key will change the display to the current time (adjusted for any fast time minutes elapsed while in this editing mode).

5.3   Alarm Time ("ALAr")

The alarm time can be changed by pressing the **SEL** key when the display shows "ALAr". The existing alarm time will be shown and the alarm indicator will be illuminated. The PM indicator will only be illuminated if you've chosen the 12 hour time format and the current time is PM! For example, if the existing alarm time is 10:30pm (12 hour format) the display will look like this:
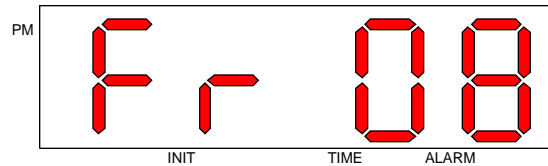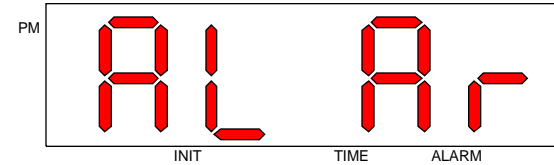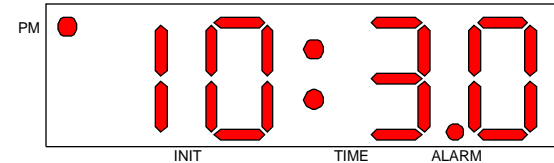

Change the hours by pressing the **+/HRS** key; the hours will increment from the current setting up to 23 (or 11pm) and then "wrap-around" to 00 (or 12am). Change the minutes by pressing the **-/MIN** key; the minutes will increment from the current setting up to 59 and then "wrap-around" to 00. If you change your mind and don't wish to change the alarm time, simply press the **MODE** key; the display will return to the current time (adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the new alarm time press the **SEL** key; the new alarm value will be in effect and stored in non-volatile memory as well. The display will then show a DCC Accessory Decoder switch address. If the Alarm Event Trigger is enabled (see section 5.3) then this LNFC will send a trigger to this switch address when the alarm time is reached. Here is an example of what the display might look like:
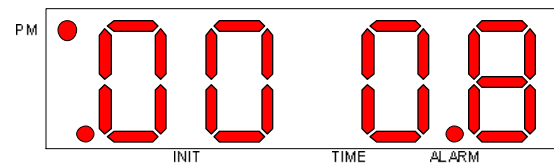
Notice that the alarm indicator is illuminated and the leftmost decimal point indicator is also lit. This indicates that the display is showing the switch address (in this case switch address 8) associated with the Alarm Event Trigger. In this example the PM indicator is also illuminated; this indicates that when the event trigger is sent it will set the switch to **closed**. If the PM indicator was not illuminated then when the event trigger is sent it will set the switch to **thrown**.

Change the tens and units portion of the switch address by pressing the **-/MIN** key; the right two digits will increment from the current setting up to 99 and then "wrap-around" to 00. Change the thousands and hundreds portion of the switch address by pressing the **+/HRS** key; the left two digits will increment from the current setting up to 20 and then "wrap-around" to 00. You will notice that each time you go from 20 to 00 the PM indicator will flip-flop (i.e. go from off to on or on to off); this is how you select whether you want the event trigger to set the switch to closed (PM indicator **on**) or thrown (PM indicator **off**). **NOTE: legal DCC accessory decoder addresses must be in the range of 1 (displayed as 0001) to 2044. The LNFC does NOT check the validity of address you enter so unpredictable results may occur if you enter a value of 0 (0000) or 2045 through 2099.**

If you change your mind and don't wish to change the switch address, simply press the **MODE** key; the display will return to the current time (adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the switch address and switch state press the **SEL** key; the display will then show "ALAr" again. The switch address will be in effect and stored in non-volatile memory as well. At this point pressing the **MODE** key will change the display to the current time (adjusted for any fast time minutes elapsed while in this editing mode). When the current time matches the alarm time the LNFC-1 will beep five times if the alarm is enabled (see Section 5.8) and a trigger sent to the associated DCC Accessory Decoder switch address if enabled (see Section 5.3).

5.3 Event Trigger ("Etr")
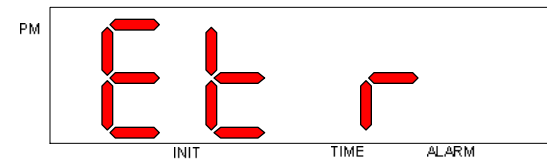
Pressing the **SEL** key when the display shows "Etr" will allow you to enable or disable the Event Triggers for this LNFC. After selecting which events are enabled/disabled you can set each event's (with the exception of the alarm event; see section 5.2) start and end time as well as the DCC accessory decoder switch address that is being controlled. When you press the **SEL** key when "Etr" is shown the current value of the Event Enables will be displayed. For example, if the Alarm Event and Event Trigger #1 are enabled (others disabled) then the display would look like this:
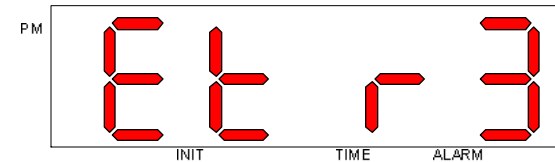
The event trigger enables are defined in the following table. Each event trigger enable is represented by a single "bit" and has an associated "weight."

Bit Weight	Trigger	Definition
1	Alarm Event	**1:** The Alarm Event Trigger is Enabled **0:** The Alarm Event Trigger is Disabled
2	Event #1	**1:** Event #1 Trigger is Enabled **0:** Event #1 Trigger is Disabled
4	Event #2	**1:** Event #2 Trigger is Enabled **0:** Event #2 Trigger is Disabled
8	Event #3	**1:** Event #3 Trigger is Enabled **0:** Event #3 Trigger is Disabled

All bits are programmed to "0" when the LNFC leaves the factory. That means that by default all Event Triggers are DISABLED.

To calculate the value for the Event Trigger Enable field you must first determine what the new decimal value will be. This is done by adding the

"weights" for each of the events that you want to enable. For example, if you want to enable the Alarm Event, Event #2, and Event #3 then you would add the following values:

$$1 \quad + \quad 4 \quad + \quad 8 \quad = \quad 13$$
(Alarm Event + Event #2 + Event #3)

For any events that you want to disable simply don't add in their bit weights. Now that you have the decimal (base 10) value you need to convert it to its hexadecimal (base 16) equivalent. You should already be familiar with this from other Digitrax products. Nonetheless we have included a handy decimal to hexadecimal conversion chart in Section 5.8. So for our example the hexadecimal equivalent for 13 decimal is D.

Use the +/**HRS** and **-/MIN** keys to adjust the value on the display. Pressing the +/**HRS** key will increment the option switch value; the value will increment from the current setting up to F and then "wrap-around" to 0. You can decrement the value by pressing the **-/MIN** key; the value will decrement from the current setting down to 0 and then "wrap-around" to F. If you change your mind and don't wish to change the Event Trigger Enable value simply press the **MODE** key; the display will return to the current time (adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the new value press the **SEL** key; the Event Trigger Enable value will be in effect and stored in non-volatile memory as well. Also, the display will change to this:
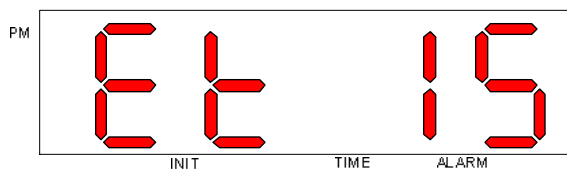
This indicates that you are now going to specify the **Start** time for Event #1. You can select a different event number by pressing the +/**HRS** or **-/MIN** keys. Once you have chosen an event number press the **SEL** key. The display will then show the current event start time. The PM indicator will only be illuminated if you've chosen the 12 hour time format and the current time is PM! For example, if the existing event start time is 6:30pm (12 hour format) the display will look like this:
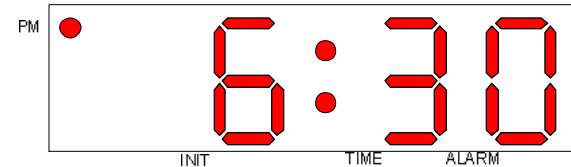
Change the hours by pressing the **+/HRS** key; the hours will increment from the current setting up to 23 (or 11pm) and then "wrap-around" to 00 (or 12am). Change the minutes by pressing the **-/MIN** key; the minutes will increment from the current setting up to 59 and then "wrap-around" to 00. If you change your mind and don't wish to change the event start time, simply press the **MODE** key; the display will return to the current time (adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the event start time press the **SEL** key; the start time value will be in effect and stored in non-volatile memory as well. The display will change to this:
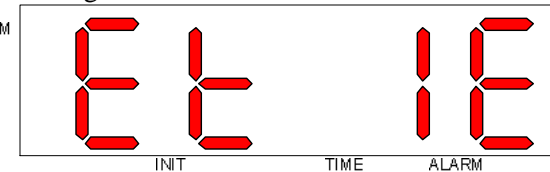

This indicates that you are now going to specify the **End** time for Event #1. You can select a different event number by pressing the **+/HRS** or **-/MIN** keys. Once you have chosen an event number press the **SEL** key. The display will then show the current event end time. The PM indicator will only be illuminated if you've chosen the 12 hour time format and the current time is PM! For example, if the existing event end time is 9:05pm (12 hour format) the display will look like this:
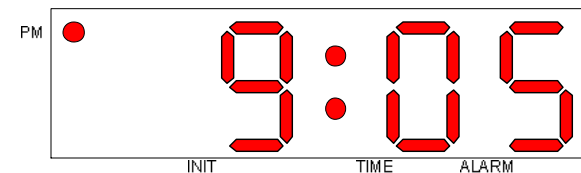
Change the hours by pressing the **+/HRS** key; the hours will increment from the current setting up to 23 (or 11pm) and then "wrap-around" to 00 (or 12am). Change the minutes by pressing the **-/MIN** key; the minutes will increment from the current setting up to 59 and then "wrap-around" to 00. As described in Section 1.3, if an event's start and end times are equal the event trigger will be a "one-shot" type; otherwise it will be a

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"duration" type. If you change your mind and don't wish to change the event end time, simply press the **MODE** key; the display will return to the current time (adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the event end time press the **SEL** key; the end time value will be in effect and st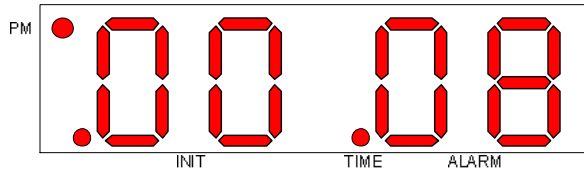ored in non-volatile memory as well. The display will then show a DCC Accessory Decoder switch address. If this Event Trigger is enabled then this LNFC will send a trigger to this switch address when this event's start time is reached. Here is an example of what the display might look like:


Notice that the time indicator is illuminated and the leftmost decimal point indicator is also lit. This indicates that the display is showing the switch address (in this case switch address 8) associated with an Event Trigger. The PM indicator denotes the state of the switch for the event trigger when the event start time is reached. When the PM indicator is illuminated the switch will be set to **closed**; when the PM indicator is not illuminated the switch will be set to **thrown**. When the event end time is reached (assuming it's not equal to the start time) then the event trigger is sent with the switch to be set to the opposite state.

Change the tens and units portion of the switch address by pressing the **-/MIN** key; the right two digits will increment from the current setting up to 99 and then "wrap-around" to 00. Change the thousands and hundreds portion of the switch address by pressing the **+/HRS** key; the left two digits will increment from the current setting up to 20 and then "wrap-around" to 00. You will notice that each time you go from 20 to 00 the PM indicator will flip-flop (i.e. go from off to on or on to off); this is how you select whether you want the event trigger to set the switch to closed (PM indicator **on**) or thrown (PM indicator **off**). **NOTE: legal DCC accessory decoder addresses must be in the range of 1 (displayed as 0001) to 2044. The LNFC does NOT check the validity of address you enter so unpredictable results may occur if you enter a value of 0 (0000) or 2045 through 2099.**

If you change your mind and don't wish to change the switch address, simply press the **MODE** key; the display will return to the current time

(adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the switch address and switch state press the **SEL** key; the switch address will be in effect and stored in non-volatile memory as well. The display will then show "Et#S" again where "#" is the next event number. At this point you can repeat the above procedure for another event trigger or you can press the **MODE** key to exit this editing mode; the display will change to the current time (adjusted for any fast time minutes elapsed while in this editing mode).

5.5   Brightness ("brit")
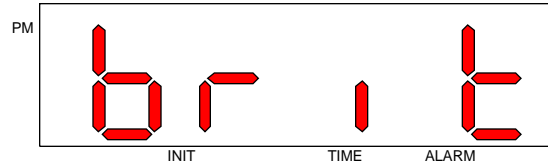
The display brightness can be changed by pressing the **SEL** key when the display shows "brit". The current brightness setting will be shown. "br L" means low brightness; "br H" means high brightness; "br A" means automatic brightness (Low from 7:00pm to 6:30am, High from 6:31am to 6:59pm). For example, if the current brightness setting is "high" the display will look like this:

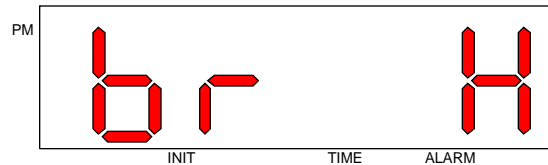Change the brightness setting by pressing either the +/**HRS** key or the **- /MIN** key. If you change your mind and don't wish to change the brightness setting simply press the **MODE** key; the display will return to the current time (adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the new brightness setting press the **SEL** key; the display will then show "brit" again. The new brightness setting will be in effect and stored in non-volatile memory as well. At this point pressing the **MODE** key will change the display to the current time (adjusted for any fast time minutes elapsed while in this editing mode).
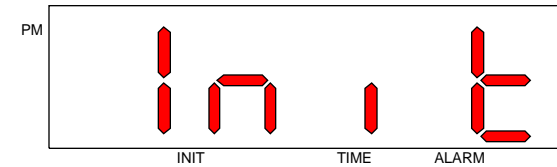
5.6   Initial/Default Time ("Init")

The initial (default upon power up) time can be changed by pressing the **SEL** key when the display shows "Init". The existing initial time will be shown and the decimal point to the lower left of the units of hours digit will be illuminated. For example, if the existing initial time is 6:00am (12 hour format) the display will look like this:
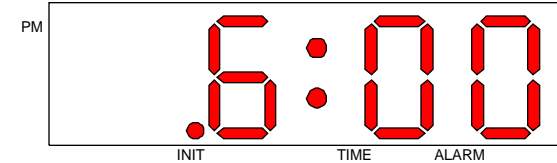
Change the hours by pressing the **+/HRS** key; the hours will increment from the current setting up to 23 (or 11pm) and then "wrap-around" to 00 (or 12am). Change the minutes by pressing the **-/MIN** key; the minutes will increment from the current setting up to 59 and then "wrap-around" to 00. If you change your mind and don't wish to change the initial time simply press the **MODE** key; the display will return to the current time (adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the new initial time press the **SEL** key; the display will then show "Init" again. The new initial time will be in effect and stored in non-volatile memory as well. At this point pressing the **MODE** key will change the display to the current time (adjusted for any fast time minutes elapsed while in this editing mode).

5.7   Code Revision ("Co X.Y")

The current code revision is displayed. The example above would indicate that this LNFC-1 contains software code revision 4.0. Normally you don't need to be concerned with this. However, if you require technical support we may ask you for this information.

Pressing the **MODE** key will change the display to the current time (adjusted for any fast time minutes elapsed while in this editing mode).
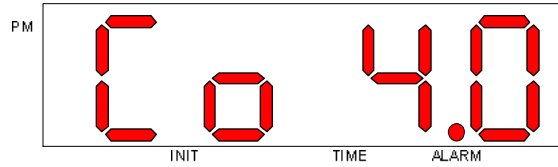
5.8   Option Switch (oPtn)
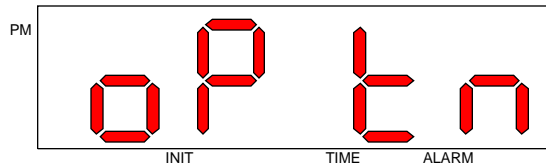

The option switch setting can be changed by pressing the **SEL** key when the display shows "oPtn". The option switch functions are defined in the following table. Each option is represented by a single "bit" and has an associated "weight."

Bit Weight	Usage	Actions
1	12 Hour Format	**1:** Time is displayed in a 12 hour format utilizing PM indicator. **0:** Time is displayed in a 24 hour format; the PM indicator is not used.
2	Clock Master Disable	**1:** LNFC is disabled as the Clock Master. **0:** LNFC is enabled as the Clock Master.
4	Time Tick	**1:** Flash colon when clock is ticking (Fast Rate > 0 and clock not paused). We recommend that you do not enable this feature and the Alarm Flash Colon. **0:** Do not flash colon when clock is ticking.
8	Alarm Flash Colon	**1:** Flash colon when alarm time is reached. We recommend that you do not enable this feature and the Time Tick or Alarm Flash Indicator. **0:** Do not flash colon at alarm time.
16	Alarm Flash Indicator	**1:** Flash alarm indicator when alarm time is reached. We recommend that you do not enable this feature and the Alarm Flash Colon. **0:** Do not flash alarm indicator at alarm time.
32	Alarm Disable	**1:** Disable alarm from sounding or flashing colon or alarm indicator. **0:** Enable alarm to sound and flash colon (if Alarm Flash Colon = 1) or alarm indicator (if Alarm Flash Indicator = 1).
64	Power-on Pause	**1:** Time is paused when LNFC is first powered on. This feature only applies to the Clock Master (see above). **0:** Time starts running when LNFC is first powered on.

All bits are programmed to "0" when the LNFC leaves the factory. That means that by default the LNFC:

- Displays time in a 24 hour format like the DT100 throttle
- Is enabled as the master clock with the time running
- Does NOT flash the colon when the time is "ticking"
- Does NOT flash the colon when the alarm time is reached
- Does NOT flash the alarm indicator when the alarm time is reached
- Has its local alarm enabled

When you press **SEL** the display will look something like this:
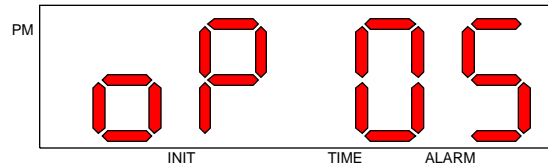
In this example the LNFC would display time in a 12 hour format and would flash the colon when the clock is running (fast rate > 0).

To change a function value you must first determine what the new decimal value will be for the option switch. This is done by adding the "weights" for each of the functions that you want to have set to "1." For example, if you want to have the time displayed in a 12 hour format, have the colon flash when the clock is running (fast rate > 0) and disable the local alarm then you would add the following values:

> 1   +   4   +   32   = 37
> (12 Hour Format + Time Tick + Alarm Disable)

For any functions that you want to set to "0" simply don't add in their bit weights. Now that you have the decimal (base 10) value you need to convert it to its hexadecimal (base 16) equivalent. You should already be familiar with this from other Digitrax products. Nonetheless we have included a handy decimal to hexadecimal conversion chart here.

Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
0	00	16	10	32	20	48	30	64	40
1	01	17	11	33	21	49	31	65	41
2	02	18	12	34	22	50	32	66	42
3	03	19	13	35	23	51	33	67	43
4	04	20	14	36	24	52	34	68	44
5	05	21	15	37	25	53	35	69	45
6	06	22	16	38	26	54	36	70	46
7	07	23	17	39	27	55	37	71	47
8	08	24	18	40	28	56	38	72	48
9	09	25	19	41	29	57	39	73	49
10	0A	26	1A	42	2A	58	3A	74	4A
11	0B	27	1B	43	2B	59	3B	75	4B
12	0C	28	1C	44	2C	60	3C	76	4C
13	0D	29	1D	45	2D	61	3D	77	4D
14	0E	30	1E	46	2E	62	3E	78	4E
15	0F	31	1F	47	2F	63	3F	79	4F

Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
80	50	88	58	96	60	104	68	112	70	120	78
81	51	89	59	97	61	105	69	113	71	121	79
82	52	90	5A	98	62	106	6A	114	72	122	7A
83	53	91	5B	99	63	107	6B	115	73	123	7B
84	54	92	5C	100	64	108	6C	116	74	124	7C
85	55	93	5D	101	65	109	6D	117	75	125	7D
86	56	94	5E	102	66	110	6E	118	76	126	7E
87	57	95	5F	103	67	111	6F	119	77	127	7F

So for our example the hexadecimal equivalent for 37 decimal is 25.

Use the +/**HRS** and -/**MIN** keys to adjust the value on the display. Pressing the +/**HRS** key will increment the option switch value; the value will increment from the current setting up to 3F and then "wrap-around" to 00. You can decrement the value by pressing the -/**MIN** key; the value will decrement from the current setting down to 00 and then "wrap-around" to 3F. If you change your mind and don't wish to change the option switch value simply press the **MODE** key; the display will return to the current time (adjusted for any fast time minutes elapsed while in this editing mode). Once you are satisfied with the new option switch value press the **SEL** key; the display will then show "oPtn" again. The new option switch setting will be in effect and stored in non-volatile memory as well. At this point pressing the **MODE** key will change the display to the current time (adjusted for any fast time minutes elapsed while in this editing mode).

5.9   Reset ("rSt")
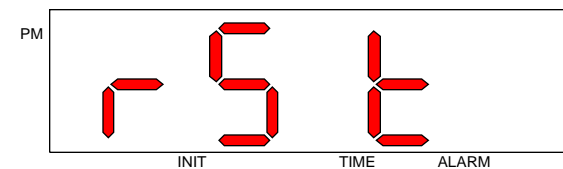
When "rSt" is displayed you can reset the time to the initial time (as described in section 5.5) by pressing the **SEL** key. Note that this action is only carried out IF this LNFC is enabled as the Clock Master (see section 6.1).

Pressing the **MODE** key will change the display to the current time (adjusted for any fast time minutes elapsed while in this editing mode). If the **MODE** key is pressed before the **SEL** key is pressed then no reset action is taken.

6.   Multiple LNFCs

6.1   Establishing the Clock Master

When using multiple LNFCs on the same LocoNet it is necessary to assign ONE the role of *Clock Master* and the OTHERS as *Clock Slaves*. The role of Clock Master simply means that one module is responsible for broadcasting the initial/default time when it is first powered up. It is responsible for periodically (about once every 50 to 60 seconds) sending out a "synchronization message" so that all fast clock-aware devices on the LocoNet synchronize their local time base. Clock Slaves will first show their initial time when first powered on but will synchronize to Clock Master within 60 seconds. Clock Slaves only listen to LocoNet messages for new time and fast rate information. **ALL LNFCs are capable of changing the current time and fast rate via their front panel keys regardless of their role as Clock Master or Clock Slave.**

As described in Section 5.7 all LNFCs are enabled as the Clock Master by default (factory setting). As such you must choose one LNFC as the master and change the option switch setting (make sure Clock Master Disable is "1") for the remaining LNFCs.

6.2   Network Clock Control vs. Local Control

The current messages supported by LocoNet allow you to change the current time and fast rate from any LNFC, DT100 (and DT100R, DT100IR), and some computer-based applications. This is what we consider *Network Clock Control*. Whenever the fast rate is changed it will be updated in the non-volatile memory of ALL LNFCs.

All other LNFC attributes (alarm time, hour format, initial time, brightness, display functions) are considered to be under *Local Control*. That means that when you change one of these attributes for a given LNFC it only affects that LNFC. For example, if you want the same brightness setting on all LNFCs you must edit this parameter for each and every LNFC. Future enhancements to the LocoNet architecture may allow some of these attributes to be sent across the network.

7. Pausing the clock

The clock can be paused by pressing the **-/MIN** key on the Clock Master (not on the Clock Slaves!) when in the current time mode. When the clock is paused the TIME indicator will flash on all LNFCs and the colon will stop flashing (if you enabled it to flash). All fast clock-aware devices on the LocoNet will have their fast rates set to 0 but the Clock Master will retain the fast rate used prior to entering the pause mode. The clock is also paused when the Clock Master is first powered on if the Power-on Pause option is set to 1 (see section 5.7).

In order to resume the clock simply press the **+/HRS** key on the Clock Master. The TIME indicator will stop flashing and the colon will begin flashing (if you enabled it to flash). The Clock Master will restore the previous fast rate and all fast clock-aware devices on the LocoNet will have their fast rates set accordingly.

8. LocoNet Connections

The two LocoNet jacks on the LNFC board are wired identically. As such you can use them interchangeably. The LocoNet signals, pins 3 and 4, on the two jacks are shorted together; this may be useful in some environments that require such a connection (e.g. Digitrax's UR91 radio receiver module). Also, the two ground wires on the LocoNet interface, pins 2 and 5, are connected together on the LNFC. The following diagram illustrates how the LNFC's two LocoNet jacks are wired.
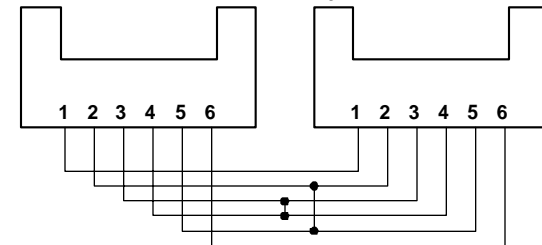

The 6-pin LocoNet cable included with the LNFC is wired in a "pass-through" style. That is, pin 1 on one end of the cable is connected to pin 1 on the other end. This should be contrasted with the "telco" style that has pin 1 on one end connected to pin 6 on the other end. If the enclosed cable is not long enough for your application you can replace it with one available from a variety of sources (e.g. Radio Shack #279-422); either style (pass-through or telco) will work.

Please note that the LNFC does NOT provide power to the LocoNet. As such you must NOT rely on the LNFC as a "keep-alive" power source (i.e. throttle battery-saver).

## 9.	Mounting the LNFC

The LNFC fascia plate is predrilled in four places for 4-40 mounting screws or bolts. Do NOT enlarge the holes – you may damage the module! You can mount the LNFC in the fascia of your layout or control panel by cutting out a hole that is 4.95" x 2.6". You'll need a depth clearance of 1.5". This is illustrated in the diagram below.
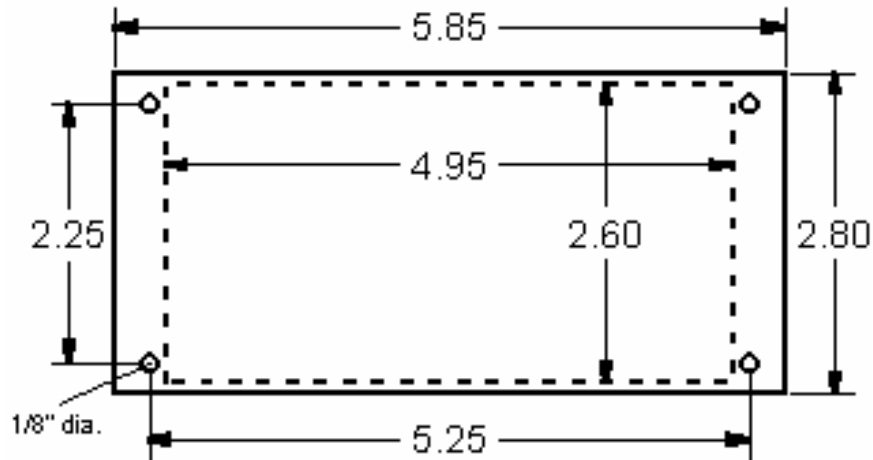
The fascia plate was designed to allow you to mount the LNFC inside a Radio Shack project box (p/n 270-1805). Discard the covers that come with the project box. Be sure to drill holes in the box to allow the LocoNet cable(s) and power connector to pass through.

10. Regulatory - FCC Information

This product has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment within the United States.

11. Warranty and Repair

11.1 Warranty

This product is warranted to be free from defects in materials or workmanship for a period of one year from the date of purchase. The product must be returned to Logic Rail Technologies in satisfactory condition. This warranty covers all defects incurred during normal use of this product. This warranty is void under the following conditions:

1. If damage to the product results from mishandling or abuse.
2. If the product has been altered in any way not previously authorized or approved by Logic Rail Technologies.
3. If the current or voltage limitations of the product have been exceeded.

Requests for warranty service must include a dated proof of purchase, a written description of the problem, and return shipping and handling ($6.00 inside U.S./$8.00 outside U.S. - U.S. funds only). Except as written above, no other warranty or guarantee, either expressed or implied by any other person, firm or corporation, applies to this product.

Logic Rail Technologies reserves the right to make changes in design and specifications, and/or to make additions or improvements in its products without imposing any obligations upon itself to install these changes, additions or improvements on products previously manufactured.

11.2 Repair

The LNFC contains no end-user serviceable parts. If you believe your LNFC needs repair please contact Logic Rail Technologies prior to returning it. Logic Rail Technologies reserves the right to repair or replace a defective product. Products that have voided the warranty or are out of warranty will be repaired at fair and reasonable rates.

12. Technical Support and Troubleshooting

12.1 Technical Support

If you purchased your LNFC from a dealer please try to contact them first for technical support. If you purchased the LNFC directly from Logic Rail Technologies or your dealer cannot resolve your problem/question please contact:

        Logic Rail Technologies
        PMB #287
        21175 Tomball Parkway
        Houston, TX 77070
        Voice/Fax: (281) 251-5813
        Email: info@logicrailtech.com

12.2 Troubleshooting

Before contacting your dealer or Logic Rail Technologies for technical support please read the following common "problems" and solutions.

1. **When the LNFC powers-up it emits three beeps instead of two.** This indicates that the contents of the non-volatile storage device on the module are invalid. Please contact Logic Rail Technologies directly for assistance.
2. **The initial/default time broadcast from the LNFC doesn't appear on the DT100/DT300/DT400.** This could indicate that the LNFC isn't configured as the Clock Master. Check the Option Switch setting. It could also indicate a bad connection somewhere on the LocoNet.
3. **The LNFC displays "LnEr".** This indicates that the LNFC encountered an error when trying to transmit a message on LocoNet. Press the **SEL** key to clear the display. If the problem persists please contact Logic Rail Technologies directly for assistance.
4. **The LNFC emits eight long beeps.** This indicates that there was a failure in an attempt to update a value in the non-volatile storage device on the module. Please contact Logic Rail Technologies directly for assistance.