



TC5net-Midi Generator/Reader/Converter LTC-Midi-USBmidi



- * **Large (0.56" / 14 mm) Bright LED Display..... Easy to Read**
- * **All Timecode Formats and Rates 23.98, 24, 24.98,25,29.97,30**
- * **Source LTCOutput: Regenerated LTC, Midi, USB Midi, (Art Net)**
- * **Source Serial MidiOutput: Regenerated LTC, Midi, USB Midi, (Art Net)**
- * **Source USB Midi.....Output: Regenerated LTC, Midi, USB Midi, (Art Net)**
- * **Source Art Net(Optional) Output: Regenerated LTC, Midi, USB Midi**
- * **Source Virtual Machine.....Output: Regenerated LTC, Midi, USB Midi, (Art Net)**
- * **Virtual Machine Controlled from 5pin Din and USB MMC Commands**
- * **Reference InputsVideo, Word Clock or Source**
- * **Timecode Regeneration..... Dropout and Jitter Suppression**
- * **Front Panel Controls Full control and setup**
- * **FP Start, Stop, Locate MMC to selected Timecode Source**
- * **Jam With/Without OffsetFrom LTC or MTC**
- * **Sync Input Video or Word Clock..... Auto Detect Frequency SD/HD Video**
- * **Real Time Clock Set from Computer**
- * **GPIO Port Start, Stop, Locate, Coincidence detector**
- * **User Configuration and Software Update.....Windows or Mac**
- * **1U 1/2 Rack (8.5x1.75", 216x44mm)..... Rack Mount Kit Included**

The TC5net-Midi replaces the TC-5b-Midi, the main difference is that the TC5net-Midi has a Optional Ethernet connector on the rear. The TC5net firmware is not compatible with the TC-5b.

The TC-5net-Midi is a professional MTC/LTC interface with LED display, Video Sync, Word Clock input and USB port. The TC-5 B-Midi is designed to be equally at home in Audio, Video and Lighting Environments, applications include Digital Audio Workstations, Non Linear Video Editors, Mixing Consoles, Show Control and Lighting Control.

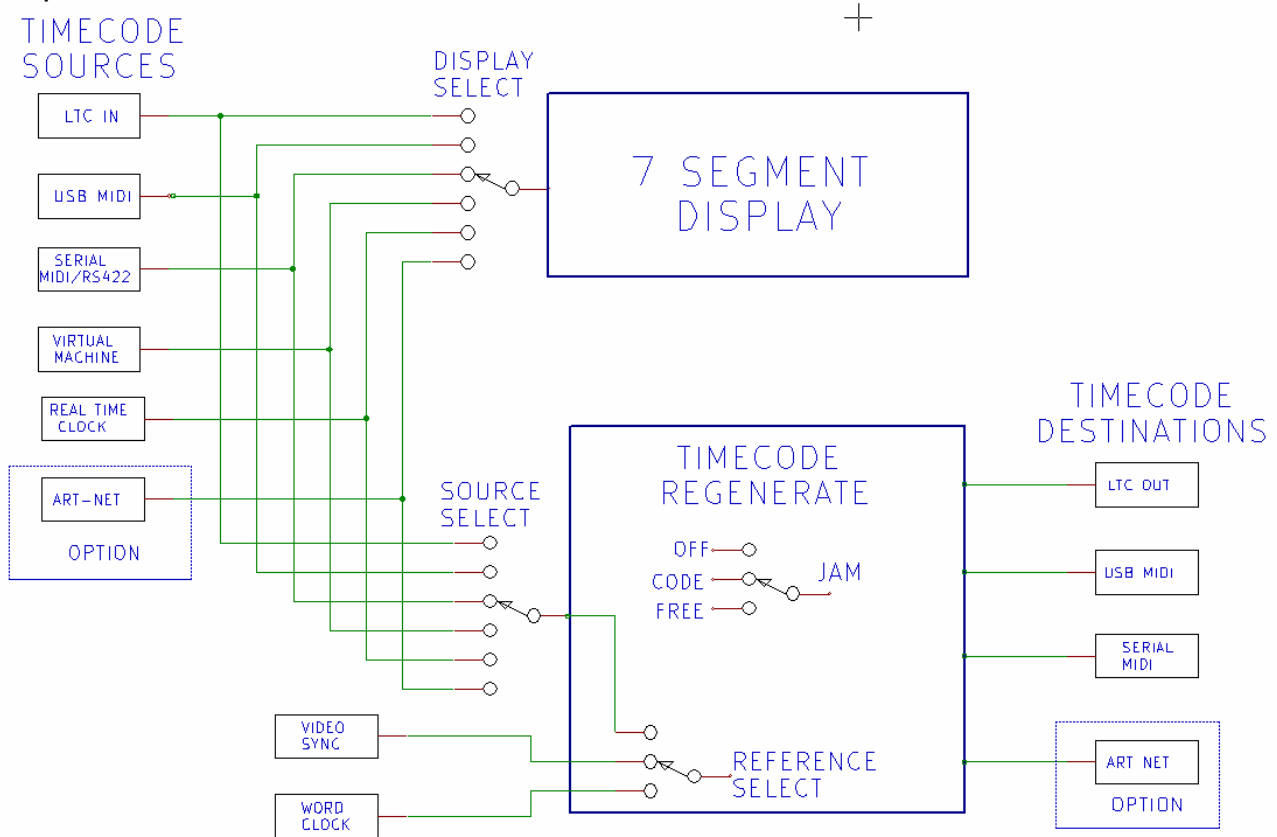
As a test tool the TC-5net-Midi can also check the frequency of Timecode, MTC, Video and Word Clock. Check the Phase of LTC, MTC or MTC over USB . Compare LTC with MTC or USB MTC.

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TC5net Block Diagram

Simplified

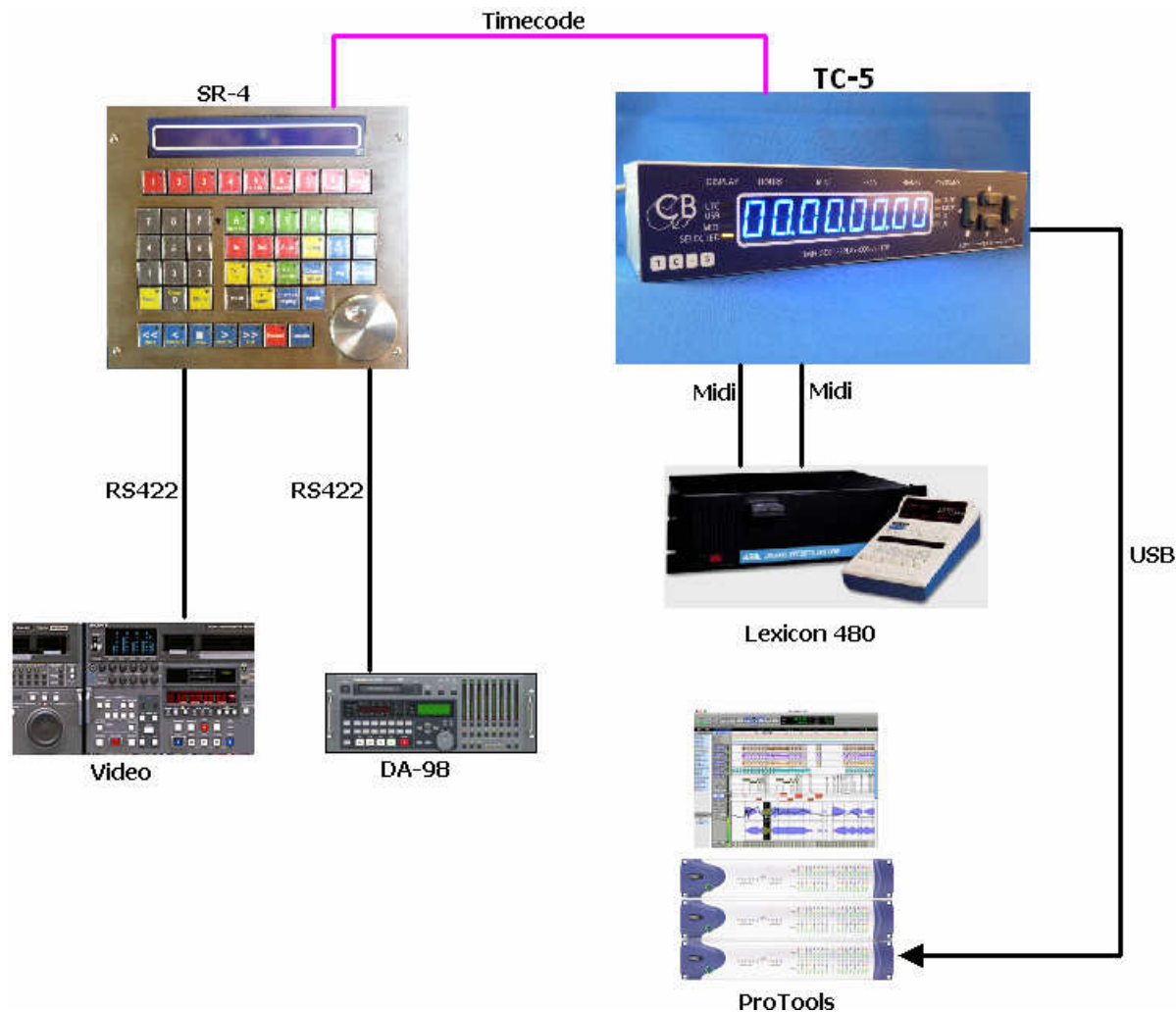


Connecting the USB Port

The USB Port is used for Power and Communications. The Firmware provides two USB channels, this enables the use of two different applications on the same computer, for example you can use the TC5NET software to control and configure the TC5NET-Midi whilst it is connected to your application.

Type	Mac Display	Windows Display	Use For
Input 1	TC-5-Midi Port 1 - CoreMIDI	TC-5-Midi - MMSystem	MTC, MMC, Configuration, Firmware Updates, TC5NET App
Input 2	TC-5-Midi Port 2 - CoreMIDI	MIDIIN2 (TC-5-Midi)-MMSystem	MTC, MMC
Output 1	TC-5-Midi Port 1 - CoreMIDI	TC-5-Midi - MMSystem	MTC, MMC, Configuration, Firmware Updates, TC5NET App
Output 2	TC-5-Midi Port 2 - CoreMIDI	MIDIOUT2 (TC-5-Midi)-MMSystem	MTC, MMC

Connecting to a DAW with USB and to Legacy Midi Equipment



Audio Only Environment

When using timecode in a digital audio environment it is important that the timecode frame rate is locked to the incoming sample rate. The TC-5 B-Midi is designed to use wordclock as a reference source. When the TC-5 B-Midi is referenced to wordclock and jammed to a timecode source the generator is phase aligned to the source after 10 frames, the timecode then free runs locked to wordclock.

Audio and Video Environments

In a Audio+Video environment there are two reference sources Wordclock and Video Syncs. They should always be locked, an easy way of doing this is to use a combined Video Sync and Wordclock generator. The timecode should be locked to the videosyncs as there are 1920 wordclocks to every video frame (48KHz/25fps). Locking to video syncs ensures that the audio keeps the correct phase relationship to the video.

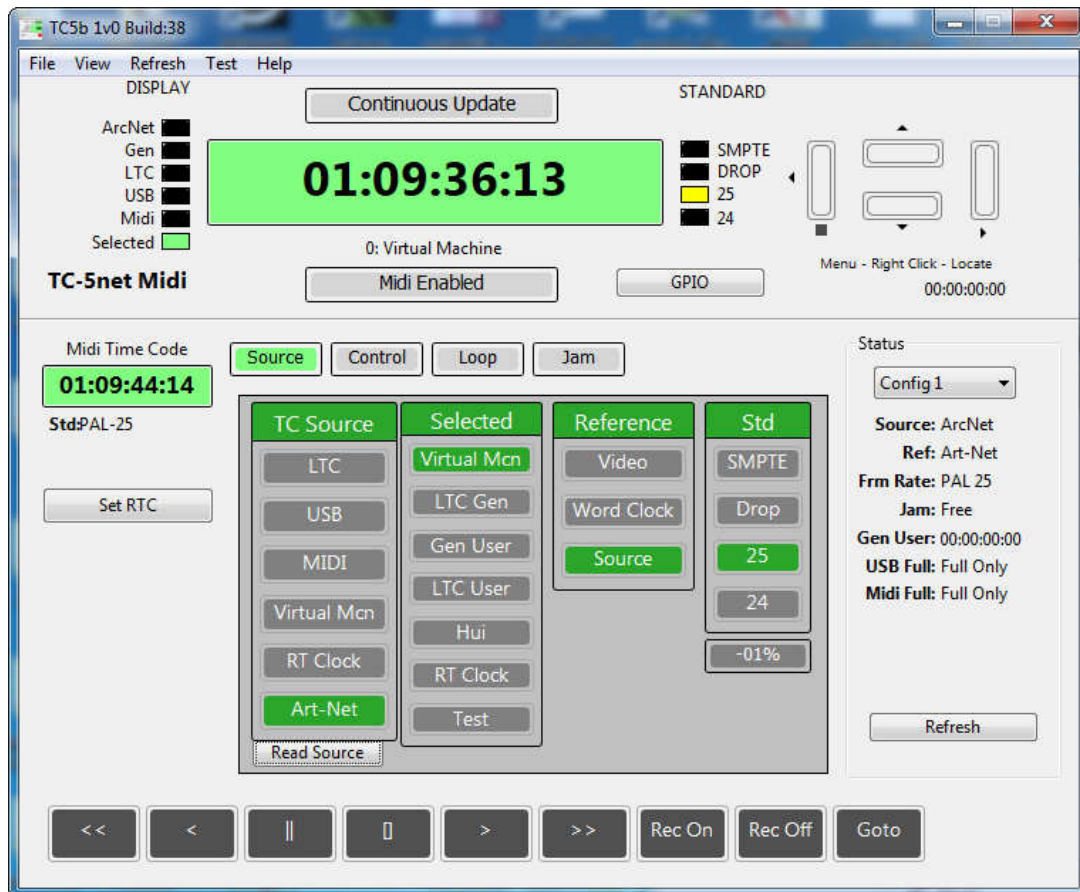
But when do you use lock to source?

Audio sources are not always locked to an external reference, in this case the TC5NET-Midi can be used in two possible ways.

- 1) If the audio source will lock to MTC then you can use the virtual machine in the TC5NET-Midi to generate both LTC and MTC locked to an external reference.
- 2) Generate LTC and MTC locked to the incoming LTC or MTC, the TC5NET-Midi averages the incoming timecode over 256 frames so as to minimise the jitter on the outgoing timecode.

Example 1 - Striping LTC on an analogue tape machine	
In this case there is no reference to the tape machine, you can use any valid reference	rEF Src Src Uir JAn OFF
Example 2 - Locking a DAW to an analogue tape machine	
As analogue tape machines are not locked to a reference connect the LTC from the tape recorder to the TC5 and USB to the DAW	rEF Src Src Ltc JAn OFF
Example 3 - Locking a DAW to an analogue tape machine with dropouts	
Use the virtual machine jammed to the source to freewheel over dropouts or discontinuities. The LTC frame edge will be used as the Generator reference.	rEF Src Src LTC JAn SrC
Example 4 - Locking a DAW to an analogue tape machine discontinuous code or large dropouts	
In this mode the virtual machine will not stop when the source timecode stops use the Stop key to stop the virtual machine. The Generator will the internal crystal as reference.	rEF Src Src LTC JAn FrEE
Example 5 - Generating LTC from DAW MTC (With Wordclock)	
The DAW is locked to word clock, Set the Wordclock Frequency in the Advanced setup (Example set to 48KHz)	rEF Cloc Src USb Cloc 48
Example 6 - Generating LTC from DAW MTC (Without Wordclock)	
The Daw is using internal reference ltc referenced to MTC	rEF Src Src USB
Example 7 - Locking a DAW to an analogue tape machine referenced to Wordclock	
Where the DAW will not varispeed to external LTC, Jam Virtual machine to LTC and run referenced to Wordclock	rEF Cloc Src LTC JAn FrEE Cloc 48

TC5net Mac or Windows Software



Note: The reference displayed is the actual reference not the Menu Setting.
The top section replicates the TC5 front panel when [Continuous Update] is enabled
The bottom section provides more information.

Midi Time Code

Midi Time code and standard sent via USB midi from TC5.

Status

Current Settings

There are 4 control Panels: Source, Control, Loop and Jam

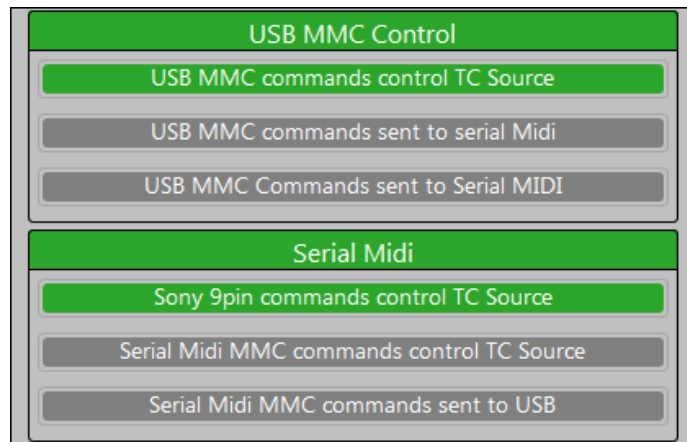
Source Panel

As Shown above has four selections as follows

1. **TC Source:** LTC, MTC and Art-Net timecode source
2. **Selected:** TC Display when Display is set to Selected
3. **Reference:** LTC and MTC Frame rate reference
4. **Std:** LTC and MTC Timecode Standard

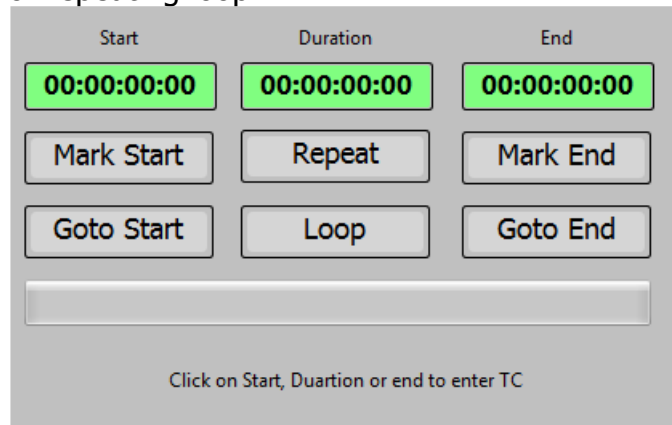
Control Panel

As shown below, select destination for USB MMC Commands or from the Serial (5pin) Midi Port.



Loop

Use to setup a single or repeating loop

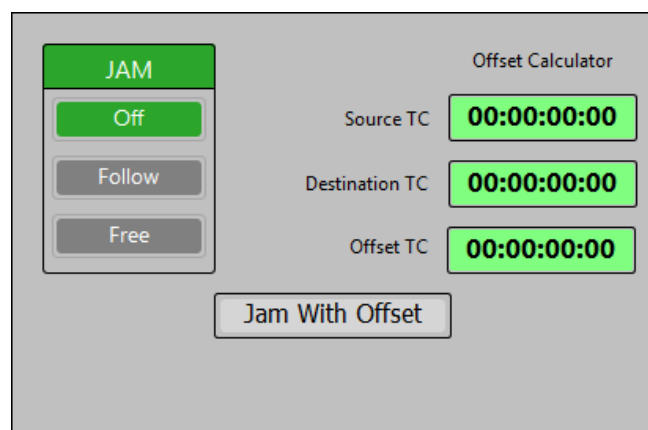


Jam with/Without Offset

Jam the Generator to a source

Jam Follow: Jam when source starts, stop when source has stopped for approx 2 seconds.

Jam Free: Jam when source starts, stop when the Stop key [<] is depressed



Lock Indication

Until the timecode output is locked to video syncs or to a external source the Timecode Standard LED will flash.

Operational Modes	
LTC -> Midi+USB+LTC	Read LTC(Smpte), convert to Midi Timecode on USB and 5 pin Din, Regenerate LTC Output
MTC -> LTC+USB	Read MTC(Midi timecode) from 5 pin Din Midi Input, convert to LTC and USB-MTC
USB -> LTC+Midi	Read MTC(Midi timecode) from USB-Midi Input, convert to LTC and 5 pin Din MTC
VMC -> LTC+Midi+USB	Generate LTC, MTC-USB and MTC 5 pin Din from virtual machine, controlled from the front panel or MMC(Midi Machine Control) on USB or 5 pin Din Input
Real Time Clock	Generate Timecode from RTC locked to Video Syncs
Timecode Conversion	Generate Timecode at a different standard to source

Using the Generator only

The generator is controlled by selection the virtual machine as the timecode source. The Generator can then be controlled from the front panel, from a computer using Midi Machine Control or the TC5NET App

Enable the config and set the Source as Virtual machine "Src Uir", set the reference as required "rEF Src" will lock to crystal, "rEF Vid" for video lock or "rEF Cloc" to lock to word clock.

Controlling the Generator from the front panel

The generator timecode may be set to any value using a locate command
Depress and hold locate ">" until only one decimal point is showing "01.000000"
Once the Locate has opened use the <, >, /, and \ keys to set the value you want
Exit locate by depress and hold the Locate key until three decimal points are showing "01.00.00.00"

Every time you enter and leave Locate the generator will locate the value that you have entered.

Depressing the ">" key will run the generator, the "[]" key will stop the generator

Generator Frame Rate Reference

In most cases the Generator is referenced to Video but it may also be locked to Internal Crystal, Word Clock, LTC or Midi. Providing multiple reference sources the TC5NET-Midi is designed to be equally at home in Audio Only environments or Combined Video and Audio Environments.

Sel	Generator Frame Rate Reference	
reF Vid	Video Syncs, bi-level(SD) or tri-level(HD)	
reF Cloc	Word Clock (Uses Video Sync input)	
reF Src	Defined by Source Menu	Src Vir – Internal Xtal
		Src Midi – 5 pin DIN Midi Timecode
		Src USB – USB Midi Timecode
		Src Ltc – Linear Timecode Input

Converting Timecode Standard

The TC5NET-Midi is not a timecode translator, however it can be used to generate timecode at a different standard from an source timecode as follows

1) Set the Generator source to

Src Ltc : LTC

or

Src Midi : Serial Midi Timecode

or

Src USB : USB Midi Timecode

2) Set the Generator Reference to

reF Src : Internal Crystal

or

reF Vid : Standard or High def video syncs

or

reF Cloc: Wordclock

3) Set the generator Standard & Rate to the required value

4) Set the Jam Type to

JAn Src : Start and stop Virtual machine from Timecode Source

or

JAn Free : Start Virtual Machine from TC Source, Manual Stop

5) Enable Jam :

Jan Norm : Jam to Source without Offset

or

Jan OFSt : Jam with Offset (The Locate Timecode is added to incoming LTC)

In this Mode the Generator will start (and stop) with the Virtual Machine Jam Source.

When the Jam Source timecode starts the jam source timecode value will be transferred to the Virtual machine and the Virtual machine will Start.

When the Jam Source stops the virtual machine will stop and the jam source timecode value will be transferred to the Virtual machine.

The Generator will follow the Virtual Machine.

Front Panel Leds and Switches

LED	Display –Normal Operation	
ENET	Art net Timecode- Only available if Ethernet Option is fitted	
GEN		
LTC	LTC(Smpte) Linear Time Code	
USB	USB Midi Timecode	
Serial	5 pin Din Midi Timecode	
Selected	Defined by Configuration Menu	SEL Vir Virtual Machine Timecode
		SEL GEn Generator Timecode
		SEL GEnU Generator User Bits
		SEL LtcU LTC User Bits
		SEL hui USB/Midi Hui Counter
		SEL rtc Real Time Clock
		SEL tEst Show selected test function
Note: The Selected Display LED will flash if the timecode displayed is not the timecode source or Generator output.		

Keyboard/Display modes		
Keyboard/Display Mode	Display	Select/Exit
Normal Operation	Selected Position	
Config Menu	Menu Selection	Depress and Hold '<' Key
Define Locate	Locate Point/Set RTC	Depress and Hold '>' Key

Key Functions				
Mode	'<' Key	'>' Key	'^' Key	'v' Key
Normal	MMC Stop	MMC Play	Display Select	Display Select
Key-Held	Enter/Exit Config	Set/Send Locate	-	-
Config Menu	Prev menu	Next Menu	Inc Selection	Dec Selection
Define Locate	Prev Digit	Next Digit	Inc Digit	Dec Digit

Locking the Front Panel keys

To prevent inadvertent change of the timecode output the [<] and [>] keys can be locked out. The [^] and [v] keys will still operate allowing the user to look at incoming timecodes.

To lock the front panel keys, depress and hold the [v] key until "Loc On" is displayed. The [^] and [v] keys will still operate as normal but depressing the [<] or [>] key will display "Loc On"

To unlock the front panel keys, depress and hold the [^] key until "Loc OFF" is displayed.

TC5NET-Midi Configuration

To enter/exit depress and hold the [<](Config) key.

Normal Configuration Menu's			
Menu	Function	Default	Options
1	Select Config	ConFIG 1	ConFIG 1 .. ConFIG 4
2	Display Brightness	briGht 4	briGht 1 .. bright 8
3	Timecode Generator Source	Src Ltc	Src Vir : Virtual Machine Src Midi: MTC from 5 pin Din Midi Input Src USb : MTC from USB Midi Input Src Ltc : LTC Timecode Src rtc : Real Time Clock Src EnEt: Art Net
4	Generator Reference	reF Src	rEF Vid : Standard or High def video syncs rEF ClOc: Wordclock, Frame edge taken from TCG Source after 10 frames. rEF CrY: Wordclock rEF Src : Dependant on TCG Source as follows Src Vir: Internal Crystal Src Midi: 5 pin Din MTC frame rate Src USb: USB MTC frame rate Src Ltc: LTC Timecode frame rate Src rtc : Internal Crystal Src EnEt: Art Net frame rate
5	Ethernet Output	AnEt OFF	AnEt oFF: Art Net Time Code Output Off AnEt On: Art Net Time code Output On
6	Standard & Rate	PAL25	PAL25, Nond 30, Filn 24, droP 30 PAL 249, Nond 299, Filn 239, droP 299 Note: Updated by reference if present
7	Generator User	00	00 : No User - 00:00:00:00 GU LtcU : Reader User Bits GU FEEt : Footage from Gen Preset (Locate Point) GU Hui : USB Hui Positional Display GU Hui Ft : Hui TC converted to Feet GU rtc : Time of Day

8	LTC Stationary code	StAt OFF	StAt ON :Stationary Timecode Always On StAt OFF :Burst Output on position change
9	Selected Display	SEL Gen	SEL Uir : Virtual Machine SEL Gen : LTC Generator Sel GenU : LTC Generator User bits SEL LtcU : LTC Reader User bits SEL Hui : Hui Clock Display from Midi or USB SEL rtc : Real Time Clock SEL tEST : Test function see menu 8
10	Jam Enable	JAn OFF	JAn OFF : Jan SrC : Start and Stop from Source Jan FrEE : Jam Start from Source Manual Stop Note: The Virtual machine is jammed to the Jam source on Start and Stop only
11	Jam Offset	No JOFSt	No JOFSt : Jam Without Offset JAn OFSt : Jam With Offset (locate Point)
12	USB ID	USb Id 0	USb Id 0, USb Id 1, USb Id 2, USb Id 3, USb Id 4, USb Id 5, USb Id 6, USb Id 7
13	USB Full Timecode	USB Full	USB FulLoc : Send Full frame and Locate USB Full : Send Full frame message only U LocAtE : Send Midi Locate only
14	USB MMC Commands	UCnd Src	UCnd Src : Control Timecode Source UCnd Vir : Control Virtual Machine UCndNidi : Control serial Midi
15	Serial Midi ID	Nidi Id 0	Nidi Id 0, Nidi Id 1, Nidi Id 2, Nidi Id 3, Nidi Id 4, Nidi Id 5, Nidi Id 6, Nidi Id 7
16	Serial Midi Full Timecode	Nidi Full	N FullLoc : Send Full frame and Locate Nidi Full : Send Full frame message only N LocAtE : Send Midi Locate only
17	Serial Midi MMC Commands	NCnd Src	NCnd Src : Control Timecode Source NCnd Vir : Control Virtual Machine NCndUSB : Control USB Midi
18	Measured Word Clock Rate	Cloc 48	Cloc 44.1, Cloc 48, Cloc 88.2, Cloc 96, Cloc 176.4, Cloc 192
19	Reset to Factory	No ChAnG	No ChAnG : No action FACTory : Resets selected config to Factory Defaults

TC-5net-Midi Advanced Configuration

When Advanced mode is enabled (Windows/Mac GUI) the following enhanced menu's are available. These allow the TC5NET-Midi to be used to test the reference frequency and compare time codes.

Advanced Configuration Menu's		
Menu	Function	Options
20	Test Display	t0 rEF: Reference frame rate t1 Cloc: Wordclock Samples per second t2 Lt Ph: LTC Phase t3 Ni Ph: 5 pin Din MTC Phase t4 Ub Ph: USB MTC Phase t5 Ur-Lt: Difference Virtual machine - LTC, t6 Ur-Ub: Difference Virtual Machine – USB MTC t7 Ur-Ni: Difference Virtual Machine – 5pin Din MTC t8 Lt-Ub: Difference LTC – USB MTC t9 Lt-Ni: Difference LTC – 5 pin Din MTC tA Ub-Ni: Difference USB MTC – 5 pin Din MTC tb Ab Ph: Art Net Phase tC Ur-An: Difference Virtual machine - Art Net
21	USB ID	Id tC5: Normal ID ID UiStA: Special ID for Evertz Vista

GPIO Connections 25 pin 'D' Female on TC5NET-Midi

Pin	O/P	I/P	GP Output Function	GP Input Function
1		GPI-9	N/A	Zero Feet
14	GPIO-1			Midi Record On
2		GPI-10	N/A	
15	GPIO-2			USB Record On
3		GPI-11	N/A	
16	GPIO-3			Midi Record Off
4		GPI-12	N/A	
17	GPIO-4			USB Record Off
5		GPI-13	N/A	
18	GPIO-5			
6		GPI-14	N/A	
19	GPIO-6			Source Stop
7		GPI-15		
20	GPIO-7			Source Locate
8		GPI-16	N/A	
21	GPI-8		N/A	Play
9		Bi-A		Future Use
22				
10		BI-B		Future Use
11, 12, 13	Ground			
23,	+5v			

24, 25	
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GPO Event programming

Using the Mac/Windows program you can program up to 100 timecode events on the GP Output ports and send MMC commands on the USB and Serial midi ports. The GPIO screen can be accessed via the View menu.

By default all GPO's are cleared on stop, the Clear On Stop Mask can be used to disable this. The GPO's pulse for about 100mSec and can be selected to Latch(Toggle).

By default all GPI's are enabled, the GPI Mask can be used to disable the Midi/USB and Source transport commands, The timecode coincidence detector uses the timecode generator so that timecode dropouts are ignored care should be taken to ensure that the correct source and reference are selected.

Currently only the configuration is read from the TC5NET-Midi not the events

For an example see below

Simple GPO Example

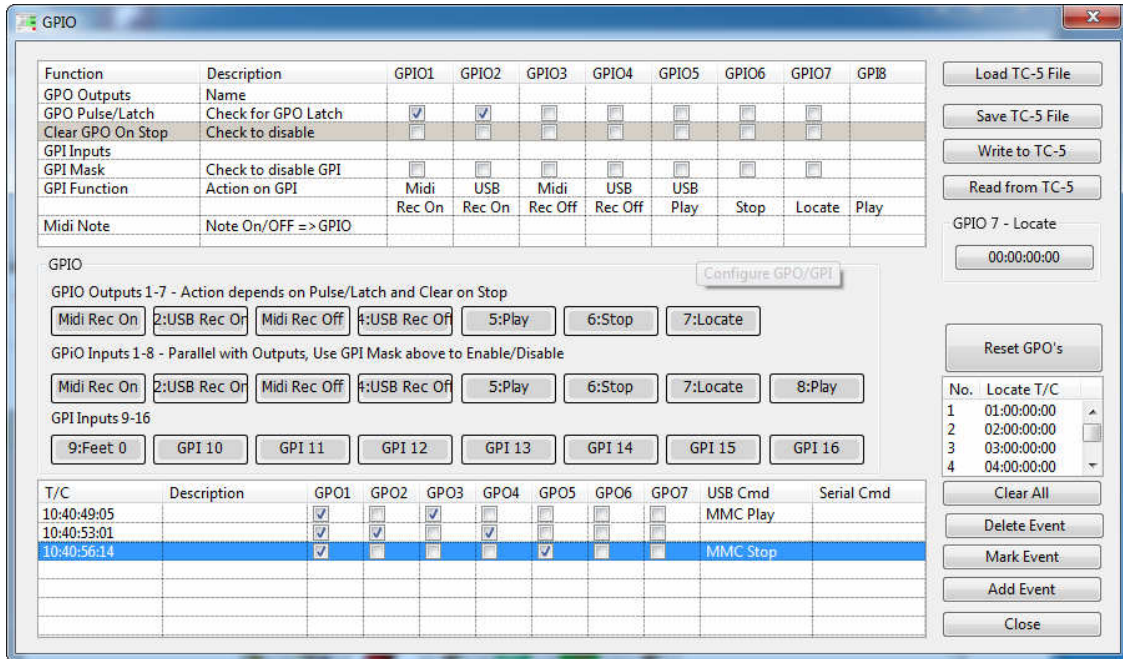
In the following example the timecode source is LTC
MMC Commands are use to control a DAW

GPIO O/P 1 & 2 are Latching Outputs

GPIO O/P 3 - 7 are Pulse Outputs

GPIO O/P 1-7 will go Off if the timecode stops

GPIO I/P 1 – 7 are disabled by the GPIO Mask

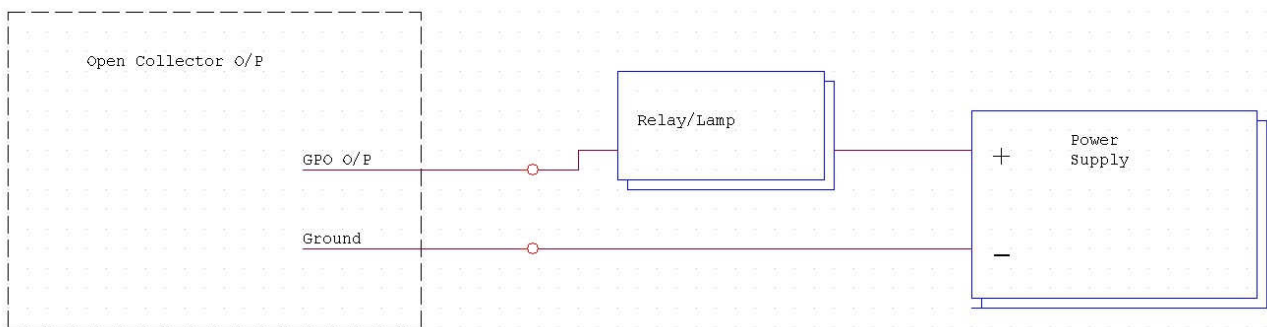


When Timecode runs						
Timecode	GPO1 (Latched)	GPO2 (Latched)	GPO3	GPO4	GPO5	DAW
10:40:40:00	Off	Off	Off	Off	Off	
10:40:49:05	On	Off	On	Off	Off	Play
10 frames later	On	Off	Off	Off	Off	
10:40:53:01	On	On	Off	On	Off	
10 frames later	On	On	Off	Off	Off	
10:40:56:14	On	Off	Off	Off	On	Stop
10 frames later	On	Off	Off	Off	Off	
When Timecode Stops						
	Off	Off	Off	Off	Off	

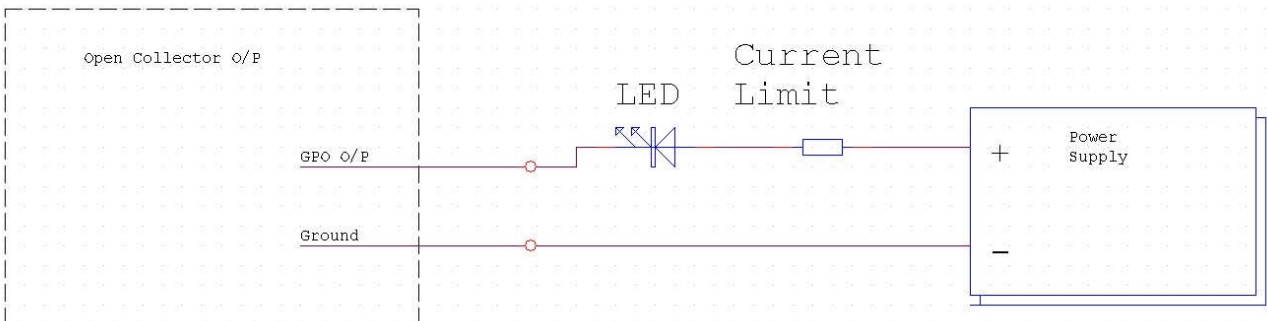
GPIO 1-7 and GPI 1-16 Schematic



Connecting a lamp to a Open collector outputs

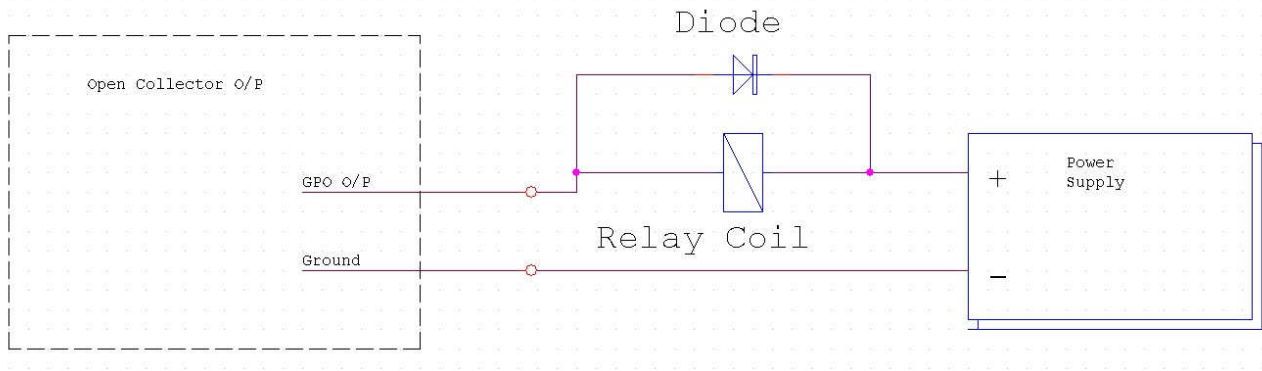


Connecting a LED to a Open Collector Output



The Current Limit resistor can be calculated typically 330R for a 5v Supply and 1K for a 12v Supply.

Connecting a Relay to a Open collector output



The Diode is optional

Recovery Mode

When programming the TC5NET-Midi a power failure or any corruption can cause the TC5NET-Midi not to work. A recovery mode is provided to overcome this problem, to enter the recovery mode-

- 1) Disconnect the Power (USB)
- 2) Depress and hold the '^' and '>' keys
- 3) Connect the Power (USB)
- 4) When the power up sequence is finished the display should read 'UPd ProG'
- 5) Re-programme the TC5NET-Midi using "USBupd-mac/win" available from - <https://www.cbelectronics.co.uk/downloads>

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