IQD

CLOCK MODULE EVALUATION BOARD EVAL-1

USER'S GUIDE

REV 1.3 FEBRUARY 2017

CONTENTS

1. SCOPE

This document relates to the use of IQD Frequency Product's clock model evaluation board EVAL-1 which is designed to allow for the testing and evaluation of IQD Frequency Products clock modules IQCM-100 and IQCM-110.

1.1. Options

1.1.1. Evaluation Board Option

This evaluation board is available in two options: with or without an on board GPS unit installed.

With no on board GPS unit installed: for testing the IQCM-110 which has an on board GPS receiver unit and so generates its own 1PPS signal. This option can also be used by users that already have an accurate 1PPS signal as the evaluation board has provision for an externally generated input signal.

With on board GPS unit installed: for testing the IQCM-100 which does not have an internal GPS unit or for users that do not have an externally generated 1PPS signal available. The GPS receiver unit is used to generate an accurate 1PPS signal so that the clock module can be locked to this signal.

The reception of a good GPS signal is required to operate in lock mode when using the installed GPS unit.

1.1.2. Clock Module Compatibility

This evaluation board is compatible with two types of clock modules:

The IQCM-100: which does not have an on board GPS unit, so the user must either connect it to an accurate external 1PPS source or purchase the EVAL-1 with the GPS option installed in order to operate in lock mode.

The IQCM-110: which has an on board GPS receiver unit does not need an external 1PPS signal to operate in lock mode. The reception of a good GPS signal is required to operate in lock mode when using the IQCM-110.

2. RELATED DOCUMENTS

- IQCM-100 specification
- IQCM-110 specification
- Ublox manual for LEA-6: http://www.u-blox.com
- Mikroe manual for GPS Clicks: http://www.mikroe.com/click/gps/

# 3. BOARD OVERVIEW

3.1. Kit Contents
- x1 Clock module evaluation PCB
- x1 Serial Cable
- x1 Power supply unit (5.0VDC @ 4A)
- x1 GPS antenna (optional)

Note: the evaluation kit does not contain a clock module this unit must be order separately from IQD Frequency Products Limited. Compactable clock module units include the IQCM-100 and the IQCM-110.

3.2. Evaluation Board Features
- Monitor the output data word from the clock module via standard serial interface on a PC
- Read clock module status via UART interface
- Monitor 1PPS and 10MHz output from the clock module via BNC connections
- Monitor GPS 1PPS signal with respect to the clock module 1PPS via BNC connections
- Switch between lock to GPS 1PPS, lock to external 1PPS or No GPD lock
- Optional on board GPS unit with GPS NMEA data accessible via USB
- LED indication of GPS lock status
- LED indication of 1PPS clock module output
- Test point connections to allow for easy monitoring of signals and status lines
- Removable clock module for testing of multiple units
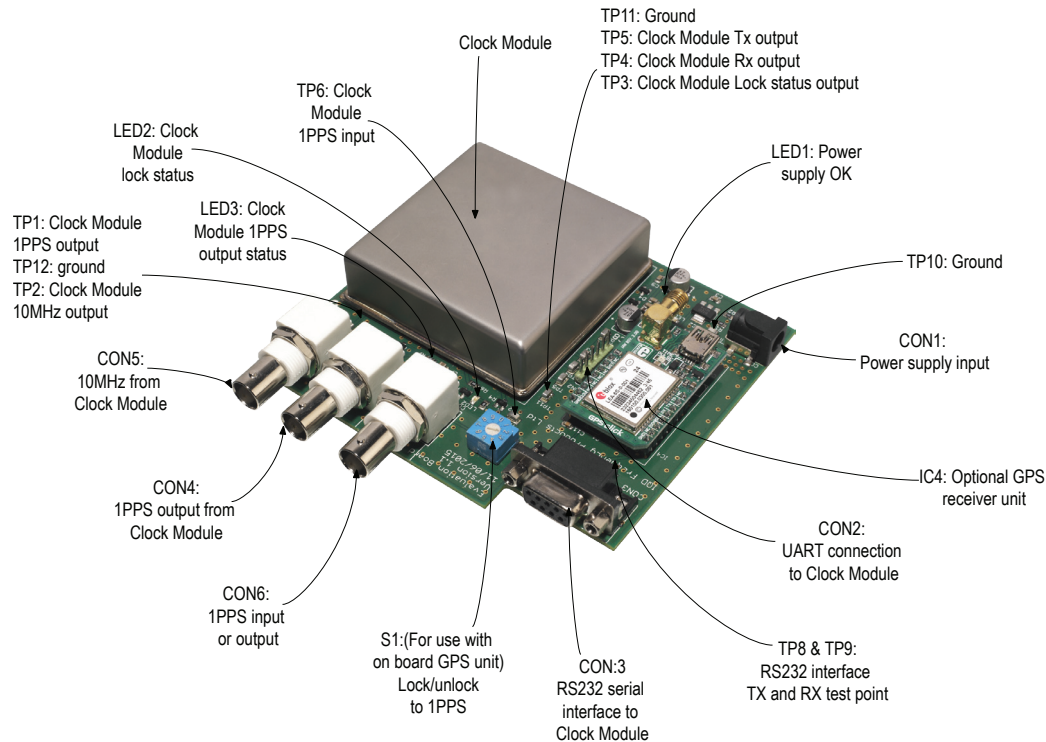
4.1. CONNECTION DETAILS

4.1.1. SW1 - Lock Mode Switch

For evaluation boards with on board GPS receivers.

This switch is used to manually switch between clock module lock mode and holdover mode whilst still being able to monitor the 1PPS GPS signal on CON6.

With the switch set to position 7 the 1PPS from the GPS unit, IC4, is connected to the clock module 1PPS input and CON6, the clock module will run in Lock mode. (Note: when monitoring the 1PPS signal from the GPS unit the load impedance must not be less than $1M\Omega$).

With the switch set to position 5 the 1PPS from the GPS unit is still connected to CON6 but disconnected from the clock module and so the clock module is forced to operate in holdover mode.

Note: Under no circumstances should the switch SW1 be placed and left in any other position than the ones stated in this user guide, doing so could mean inaccurate 1PPS readings.

For evaluation boards with no on board GPS receivers.

This switch is used to monitor the GPS 1PPS output signal on CON6.

With the switch in position 3 CON6 is connected to the GPS 1PPS output signal from the clock module. (Note: when monitoring the 1PPS signal from the GPS unit the load impedance must not be less than $1M\Omega$).

To place the clock module in holdover mode assert pin 3 "state input" on CON2.

Note: Under no circumstances should the switch SW1 be placed and left in any other position than the ones stated in this user guide, doing so could mean inaccurate 1PPS readings.

4.1.2. CON6

Used in conjunction with S1. This BNC connector is used to input and or output the 1PPS signal. This is the GPS 1PPS output only on the IQCM-110 clock module. See clock module data sheet for electrical details.

4.1.3. CON4

This BNC connector is used to output the 1PPS single generated by the clock module. See clock module data sheet for electrical details.

4.1.4. CON5

This BNC connector is used to output the 10MHz signal generated by the clock module. See clock module data sheet for electrical details.

4.1.5. CON3

This 9 way male D-type connector is used to output the data word generated by the clock module. The output is RS232 compatible. Tx is on pin 2 Rx is on pin 3, GND is on pin 5, all other pins are not connected.

4.1.6. CON2

This 2.54mm pitch pin header connector is used for UART interface to external microprocessor. Pin 1 = signal out, pin 2 = signal in, pin 3 = state in, pin 4 = lock out, pin 5 and pin 6 = GND.

4.1.7. CON1

Power supply input socket for 5.0V DC @ 4A input.

4.2. INDICTOR DETAILS

4.2.1. LED1

Indicates that the board is powered correctly.

4.2.2. LED2

Indicates the lock status of the clock module. When lit the clock module is locked to a 1PPS input.

4.2.3. LED3

Indicates the 1PPS signal generated by the clock module.

4.3. TEST POINT DETAILS

4.3.1. TP1

See CON4

4.3.2. TP2

GND

4.3.3. TP3

Clock module lock status output; see clock module specification for electrical details.

4.3.4. TP4

Clock module Rx input, see clock module specification for electrical details.

4.3.5. TP5

Clock module Tx output, see clock module specification for electrical details.

4.3.6. TP6

Clock module 1PPS input, see S1.

4.3.7. TP7

Clock module State input, see clock module specification for electrical details.

4.3.8. TP8

RS232 Tx output see CON3.

4.3.9. TP9

RS232 Rx input see CON3.

4.3.10. TP10, TP11, TP12

GND

5. SOFTWARE DESCRIPTION

5.1. Clock Module Data Interface via Personal Computer

Connect the serial cable to CON3 on the evaluation board and to a PC serial interface.

(Note: serial to USB conversation may be necessary on modern PC's with no serial port)

Open the terminal viewing software on your PC, for windows based PC's the software program HyperTerminal is recommended.

The interface settings are as follows:

- Baud rate   9600
- Parity   None
- Data bits   8bit
- Stop bit   1

Following successful connection the output data word from the clock module can be seen on the PC display.

Below is an example of the data output from an IQCM-100. The data word identifies various information regarding the internal status of the clock module including:-

1. The module is operating in lock mode.

2. The module is operating in slow track mode.

3. The current phase difference between incoming and out going 1PPS signals is -25ns (-4*6.25)

4. The module has been powered-on for 1 hour.

5. The module's internal temperature of the OCXO (e.g. 73.1°C)

6. There are no alarms active.

For full description of the data contain please see IQCM-100 specification.
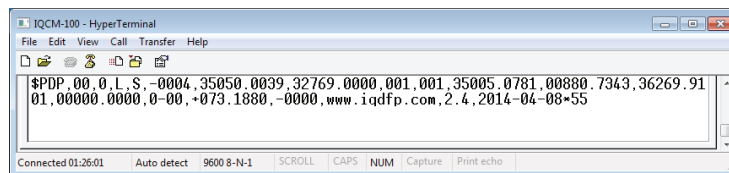
Below is an example of the data output from an IQCM-110

The data is from the on board GPS receiver unit and is in standard NMEA format, (National Marine Electronics Association) www.nmea.org.
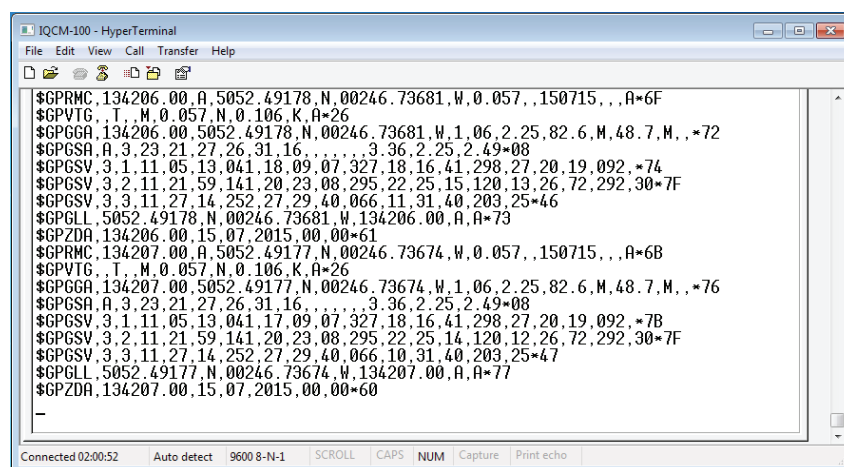
5.2. Clock Module Data Interface via UART

If the user has an existing system or microprocessor they wish to interface the clock module evaluation board with, CON2 is a quick and simple interface provided for this purpose.

CON2 provides a direct connection to the serial UART port and any applicable connections on the IQCM-100 and IQCM-110.

The connector is a standard 2.54mm pitch single in line pin header that can be connected to either by using the appropriate 6 way connector or by means of soldering.

The UART serial interface settings for CON2 are provided below as well as the pin out and pin functions:

- Baud rate   9600
- Parity   None
- Data bits   8bit
- Stop bit   1

CON2 connection description is as below:-

Pin Allocation	Pin Function
Pin1	Asynchronous serial data output
Pin2	Asynchronous serial data input
Pin3*	State input
Pin4*	Lock output
Pin5	System Ground
Pin6	System Ground

*See clock module specification for electrical details.

6. TEST SETUP

In order to test the clock module it will be necessary to use some test equipment capable of measuring the rising edge of two pulses and monitoring the difference between them. Examples of suitable test equipment could be an oscilloscope with a high sample rate, or a counter which can monitor the phase difference between two inputs.

6.1. Monitoring Holdover Performance Using External 1PPS Signal

Connect external 1PPS source to input CON6 and monitoring system

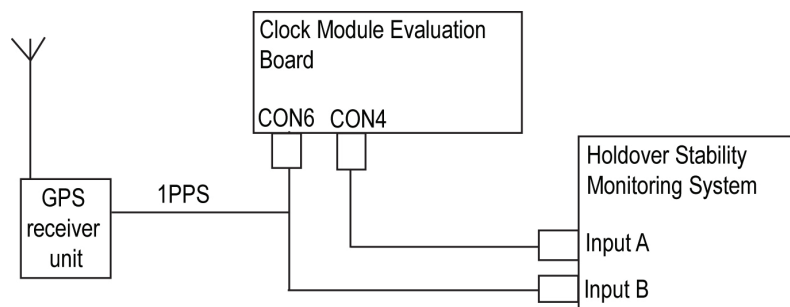Connect Clock module 1PPS output CON4 to monitoring system

Set S1 to position 3

Clock module will now run in lock mode using the external GPS input as reference signal.

Set S1 to position 5

Clock module will now operate in holdover mode

Note: To observe clock module operating within specification please leave unit running within specified temperature and environmental specification and with 1PPS lock for 3 days. After three days of operation in lock mode the module can operate in holdover mode within specified parameters.

6.2. Monitoring Holdover Performance Using On Board GPS Receiver

Connect external antenna to on board GPS unit via SMA connector.

Ensure that 1PPS LED indicator is flashing on the GPS receiver board indicating that the GPS receiver has a good GPS signal and is outputting a 1PPS signal to the evaluation board. This can take up to 5 minutes, if the LED is not flashing after this time period try repositioning the GPS antenna.
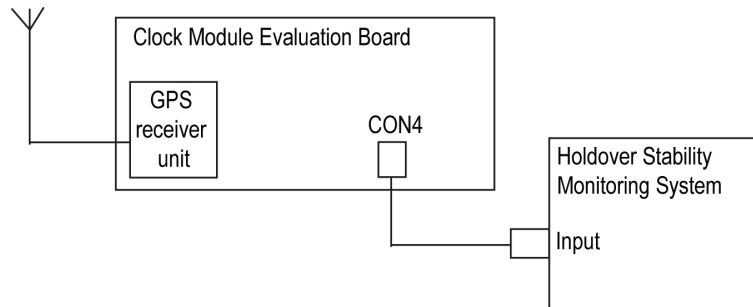
Set S1 to position 7

Clock module will now run in lock mode using the external GPS input as reference signal.

Set S1 to position 5

Clock module will now operate in holdover mode.

Note: To observe clock module operating within specification please leave unit running within specified temperature and environmental specification and with 1PPS lock for 3 days. After three days of operation in lock mode the module can operate in holdover mode within specified parameters.

6.3. Monitoring Holdover Performance Using IQCM-110 With Internal GPS Receiver

Connect external antenna to clock module via SMA connector

Connect clock module 1PPS output CON4 to monitoring system

Set S1 to position 3

CON6 now outputs the 1PPS signal from the internal GPS receiver on board the clock module

Use TP7 to control the clock module holdover status

Pull TP7 to GND to force the clock module into holdover status

Note: To observe clock module operating within specification please leave unit running within specified temperature and environmental specification and with 1PPS lock for 3 days. After three days of operation in lock mode the module can operate in holdover mode within specified parameters.
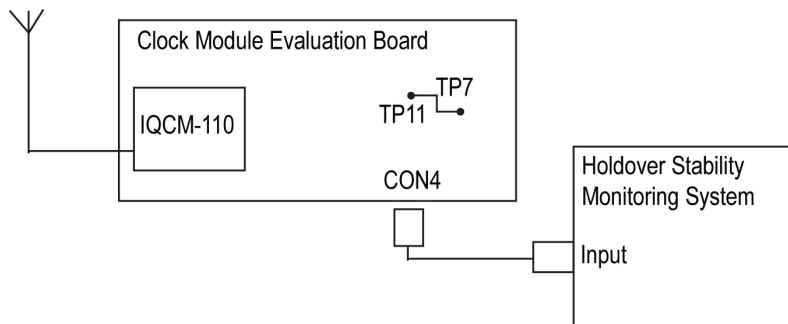
APPENDIX 1: EVALUATION BOARD CIRCUIT DIAGRAM