IQC5000B

RF Signal Record and Playback System

Operation Manual

Instruction Book Part Number 920-IQC5000 Rev. P6

Safety Precautions

The IQC5000 consists of complex precision RF test equipment and electronic hardware. Care should be taken in handling the equipment to limit shock and vibration.

This equipment is not considered user serviceable, and should only be modified or serviced by qualified personnel. Failure to do so may result in damage to the equipment, injury, or even death.

General Safety Precautions

The following are general safety precautions that are not necessarily related to any specific part or procedure, and do not necessarily appear elsewhere in this publication. These precautions must be thoroughly understood and apply to all phases of operation and maintenance.

WARNING
Keep Away From Live Circuits
Operating Personnel must at all times observe general safety precautions. Do not replace components or make adjustments to the inside of the test equipment with the high voltage supply turned on. To avoid casualties, always remove power.

WARNING
Do Not Service Or Adjust Alone
Under no circumstances should any person reach into an enclosure for the purpose of service or adjustment of equipment except in the presence of someone who is capable of rendering aid.

WARNING
Safety Earth Ground
An uninterruptible earth safety ground must be supplied from the main power source to test instruments. Grounding one conductor of a two conductor power cable is not sufficient protection. Serious injury or death can occur if this grounding is not properly supplied.

WARNING
Resuscitation
Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

WARNING
Remove Power
Observe general safety precautions. Do not open the instrument with the power on.

WARNING

Take Proper ESD Measures

Handling of electrostatic discharge-sensitive devices is to be done within an approved ESD workstation, using appropriate grounding equipment. Compliance to proper ESD protocol is essential.

Safety Symbols

WARNING

Warning notes call attention to a procedure, which if not correctly performed, could result in personal injury.

CAUTION

Caution notes call attention to a procedure, which if not correctly performed, could result in damage to the instrument.

Note: *Calls attention to supplemental information.*

Caution Statements

The IQC5000 consists of complex precision RF test equipment and electronic hardware. Care should be taken in handling the equipment to limit shock and vibration.

This equipment is not considered user serviceable, and should only be modified or serviced by qualified personnel. Failure to do so may result in damage to the equipment, injury, or even death.

The following equipment cautions appear in the text and are repeated here for emphasis.

CAUTION

RF Connector Torque Ratings

When mating RF connectors, ensure that they are properly aligned and not cross-threaded. Additionally, do not under/over torque RF connectors, as this could result in unreliable results, or worse, damaging the IQC5000. Always check manufacturer specification for proper torque ratings of all RF connectors. The table below defines the recommended torque ratings for RF connectors used within the IQC5000.

RF Connector Type	Torque Rating (inch-pounds)
SMA	8.0

CAUTION

Use extra care when connecting External MiniSAS HD connectors, the ports are keyed, but can be forced in upside-down.

CAUTION

Signal strength should not go beyond the range of the spectrum analyzer, as this can damage internal components.

CAUTION

Failure to Follow Programming Steps in Correct Order May Result in Device Failure

If the IQC5000 is power-cycled before all steps are taken, or if the unit is programmed out of the listed order, the unit may become unresponsive to further programming or cease to operate functionally.

CAUTION

Marker and Trigger Input Voltage Should Not Exceed 5V

The operating range for the marker and trigger inputs is 1 to 3.3V DC. The input voltage should not exceed 5V, as this could result in damage to the IQC5000.

Safety Statements

USAGE

ANY USE OF THIS INSTRUMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR THE INSTRUMENT'S SAFETY PROTECTION.

USO

EL USO DE ESTE INSTRUMENTO DE MANERA NO ESPECIFICADA POR EL FABRICANTE, PUEDE ANULAR LA PROTECCIÓN DE SEGURIDAD DEL INSTRUMENTO.

BENUTZUNG

WIRD DAS GERÄT AUF ANDERE WEISE VERWENDET ALS VOM HERSTELLER BESCHRIEBEN, KANN DIE GERÄTESICHERHEIT BEEINTRÄCHTIGT WERDEN.

UTILISATION

TOUTE UTILISATION DE CET INSTRUMENT QUI N'EST PAS EXPLICITEMENT PRÉVUE PAR LE FABRICANT PEUT ENDOMMAGER LE DISPOSITIF DE PROTECTION DE L'INSTRUMENT.

IMPIEGO

QUALORA QUESTO STRUMENTO VENISSE UTILIZZATO IN MODO DIVERSO DA COME SPECIFICATO DAL PRODUTTORE LA PROZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.

SERVICE

SERVICING INSTRUCTIONS ARE FOR USE BY SERVICE - TRAINED PERSONNEL ONLY. TO AVOID DANGEROUS ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

SERVICIO

LAS INSTRUCCIONES DE SERVICIO SON PARA USO EXCLUSIVO DEL PERSONAL DE SERVICIO CAPACITADO. PARA EVITAR EL PELIGRO DE DESCARGAS ELÉCTRICAS, NO REALICE NINGÚN SERVICIO A MENOS QUE ESTÉ CAPACITADO PARA HACERIO.

WARTUNG

ANWEISUNGEN FÜR DIE WARTUNG DES GERÄTES GELTEN NUR FÜR GESCHULTES FACHPERSONAL.

ZUR VERMEIDUNG GEFÄHRLICHE, ELEKTRISCHE SCHOCKS, SIND WARTUNGSARBEITEN AUSSCHLIEßLICH VON QUALIFIZIERTEM SERVICEPERSONAL DURCHZUFÜHREN.

ENTRENTIEN

L'EMPLOI DES INSTRUCTIONS D'ENTRETIEN DOIT ÊTRE RÉSERVÉ AU PERSONNEL FORMÉ AUX OPÉRATIONS D'ENTRETIEN. POUR PRÉVENIR UN CHOC ÉLECTRIQUE DANGEREUX, NE PAS EFFECTUER D'ENTRETIEN SI L'ON N'A PAS ÉTÉ QUALIFIÉ POUR CE FAIRE.

ASSISTENZA TECNICA

LE ISTRUZIONI RELATIVE ALL'ASSISTENZA SONO PREVISTE ESCLUSIVAMENTE PER IL PERSONALE OPPORTUNAMENTE ADDESTRATO. PER EVITARE PERICOLOSE SCOSSE ELETTRICHE NON EFFETTUARRE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.

About This Manual

This manual covers the operating & maintenance instructions for models:

IQC5000B

Changes to this Manual

We have made every effort to ensure this manual is accurate. If you discover any errors, or if you have suggestions for improving this manual, please send your comments to our Solon, Ohio factory. This manual may be periodically updated. When inquiring about updates to this manual refer to the part number and revision on the title page.

Chapter Layout

Introduction — Describes the features of the IQC5000B RF Recorder, lists equipment supplied and optional equipment.

IQC5000 Controls and Indicators — Describes the IQC5000B unit controls, indicators and connectors.

Setup — Describes how to set up the IQC5000B for record and playback.

Spectrum Analyzer Setup — Describes how to set up the spectrum analyzers supported by the IQC5000B; Keysight X-Series Spectrum Analyzer Setup, Rohde and Schwarz FSV/FSW, Tektronix RSA6000 Series, and Anritsu Field Master Pro MS2090A.

Operating Instructions — Describes procedures required for operating the IQC5000B.

Using IQC5000 with IQC Control — Provides instruction for installing, and using IQC control software with the IQC5000B

Post Processing IQC5000 Recorded Data — Describes the recorded data file formats.

Troubleshooting — Provides troubleshooting for common connection problems. Specifications and parts information are also included.

Maintenance — Lists routine maintenance tasks as well as guidance on building RAID0 arrays and formatting external storage units.

Sanitization — Lists the nonvolatile memory components within the IQC5000 system and provides procedures for sanitizing the system.

Firmware Configuration Updates — Provides procedures for changing unit operation from Single RAID operation to Dual RAID operation or back.

Specifications — Provides specifications for the IQC5000 system.

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Table of Contents

Chapter 1 Introduction

General Description

The IQC5000 enhances the capability of select Keysight, Rohde & Schwarz, Tektronix, and Anritsu Spectrum Analyzers (see “Compatible Spectrum Analyzers” on page 4) by increasing their signal storage capacity from seconds to hours or days. This capability gives users long duration, high-fidelity spectrum recordings to better analyze complex, wideband, time-spanning, or intermittent wave forms.

Figure 1 IQC5000B with IQC-MEM

The IQC5000 can continuously record and play back the full 16 bit I and Q data stream from these Spectrum Analyzers:

Table 1 - Recoding Bandwidths

Spectrum Analyzer	Bandwidth
Keysight X-Series	Up to 255 MHz
Rohde & Schwarz FSW	Up to 160 MHz
Tektronix RSA5000 series	Up to 165 MHz
Tektronix RSA6000 series	Up to 110 MHz
Anritsu Field Master Pro	Up to 110 MHz

The IQC5000 utilizes the Low Voltage Differential Signaling (LVDS) serial communication protocol for data transfer at very high speed. The IQC5000 is capable of simultaneously recording data from two similar spectrum analyzers outputting data at the same sample rate.

Recording

The IQC-MEM enables recording to either one or two removable internal Solid State Drives (SSD) (Option ME2), or one or two external storage units configured for RAID 0 operation. Signals are stored in a non-proprietary format to allow analysis by a wide range of digital signal processing tools. The Bird Computer Workstation and Bird’s Spectro-X software, provide users a very powerful turn-key digital signal processing capability.

Playback

Recorded broadband signals may be played back with exceptional fidelity from the IQC5000, or used to provide an analog I/Q baseband signal to a Vector Signal Generator.

The IQC5000B is capable of I/Q baseband and RF playback. The I/Q Baseband playback is intended for normal use, RF playback capability should be used for testing and system validation only. Do not use RF Playback for normal use.

Available Equipment

Base Models

The IQC5000B is the second generation of the IQC5000 family of products.

The IQC5000B base model is available in three bandwidths:

Table 2 - IQC5000B Models

IQC5000B Model	Description
IQC5040B	Signal recorder with up to 40 MHz record bandwidth. 2 LVDS inputs for each I & Q channel, with a maximum data rate of 100 MB/sec per connector. Includes IQC5000B-MEM interface module, removable AC power supply, IQC Control SW and documentation on CD.
IQC5160B	Signal recorder with up to 165 MHz record bandwidth. 2 LVDS inputs for each I & Q channel, with a maximum data rate of 400 MB/sec per connector. Includes IQC5000B-MEM interface module, removable AC power supply, IQC Control SW and documentation on CD.
IQC5255B	Signal recorder with up to 255 MHz record bandwidth. 2 LVDS inputs for each I & Q channel, with a maximum data rate of 600 MB/sec per connector. Includes IQC5000B-MEM interface module, removable AC power supply, IQC Control SW and documentation on CD.

Options and Accessories

The following options and accessories are available for the IQC5000B.

Table 3 - IQC5000B Options and Accessories

Option	Description
Memory	
IQC5000B-MEM	Memory interface module for RAID0 storage units.
IQC5000B-ME2	Internal RAID0 SSD disk storage: 2TB. Supports single channel operation up to 160 MHz bandwidth. Two units of option ME2 are required for dual channel operation at bandwidths of 160 MHz or single channel operation at 255 MHz.
IQC5000B-ME0	Additional blank memory module cover for the IQC5000B-MEM interface module.
IQC5000B-S08	External RAID0 SSD storage: 8TB, supports single and dual channel operation up to 160 MHz bandwidth.
IQC5000B-S15	External RAID0 SSD storage: 15TB, supports single and dual channel operation up to 160 MHz bandwidth.
Recording	
IQC5000B-042	Adds second recording channel to support up to 40 MHz recording bandwidth using 2ea LVDS inputs, I & Q.
IQC5000B-162	Adds second recording channel to support up to 160 MHz recording bandwidth using 2ea LVDS inputs, I & Q.
IQC5000B-XCB	LVDS Cable pair (2ea) for Signal Analyzers supporting up to 255 MHz bandwidth.
IQC5000B-ACB	LVDS Cable (1ea) for Keysight X-series Signal Analyzers supporting 40 MHz bandwidth.

Option	Description
IQC5000B-GPS	GPS/IRIG-B Timing Standard, includes GPS antenna and interface cable.
IQC5000B-RSX	Adapter for Rohde & Schwarz EX-IQ rev 04 interface box. Only compatible with EX-IQ boxes with serial numbers above 102000.
Playback	
IQC5000B-101	Adds single playback channel to support up to 160 MHz; Baseband I & Q (2ea SMA female) and RF Out at 2.4 GHz, 0dBm (1ea SMA female). Not compatible with options 042, or 162.
IQC5000B-102	Adds second playback channel to support up to 160 MHz; Baseband I & Q (4ea SMA female) and one RF Out at 2.4 GHz, 0dBm (1ea SMA female). Requires option 042, or 162.
IQC5000B-CBL	Adds one pair (2ea) of SMA-male to BNC-male cables for IQ analog playback. Each cable is 5 feet long.
PCIe	
IQC5000B-PC3	PCIe x4 Express Card 34 host cable adapter for use in laptop computers and systems that use option MEM. Includes 2 meter cable.
IQC5000B-PC4	PCIe x8 host adapter for use in desktop computers and systems that use option MEM; full height bracket. Includes 2 meter cable.
IQC5000B-PC7	PCIe x8 to x4 cable, 2 meter length.
Computer Workstation	
IQC5000B-WS1	Rackmounted SigAnalyst Workstation Dual Xeon, Quad-Core Workstation, 64GB RAM with 128 TB HDD Storage Archive (96 TB usable)
IQC5000B-WS2	Rackmounted SigAnalyst Workstation Dual Xeon, Quad-Core Workstation, 64GB RAM with 128 TB HDD Storage Archive (96 TB usable), Spectro-X and RF Editor software packages
WC-RF-EDITOR	RF Editor Signal Generation software
SPECTRO-X	Spectro-X Advanced Signal Analysis software
Accessories	
IQC5000B-RM2	19 inch Rack Mount Kit for IQC5000B with Option MEM (3U)
IQC5000B-1A5	Transit Case for IQC5000B. Case can hold the IQC5000B, IQC5000B-MEM and related accessories.
IQC5000B-ENL	Rack enclosure to house IQC5000B, down converter, 2ea solid state data packs, upconverter, workstation, storage archive and power distribution
IQC5000B-BKT	Non-rackmount bracket for affixing the IQC5000B to the IQC5000B-MEM interface module
Warranty	
IQC5000B-EX1	Extends factory warranty of IQC5000B by one additional year
IQC5000B-EX2	Extends factory warranty of IQC5000B by two additional years
IQC5000B-EX3	Extends factory warranty of IQC5000B by three additional years
IQC5000B-EX4	Extends factory warranty of IQC5000B by four additional years

Compatible Spectrum Analyzers

The IQC5000 is capable of recording digital I/Q data from the following Spectrum Analyzers:

Table 4 - Compatible Spectrum Analyzers

Vendor	Compatible Spectrum Analyzer	Supported Acq BW
Keysight	N9040B - No Options	19.531 kHz to 10 MHz
	N9040B with Option B25	19.531 kHz to 25 MHz
	N9040B with Option B40	19.531 kHz to 40 MHz
	N9040B with option B85, RTS and RT1 or RT2	19.531 kHz to 85 MHz
	N9040B with option B1A, RTS and RT1 or RT2	19.531 kHz to 125 MHz
	N9040B with option B1X, RTS and RT1 or RT2	19.531 kHz to 160 MHz
	N9040B with Option B2X or B5X, RTS and RT1 or RT2	19.531 kHz to 255 MHz
	N9030A/B - No Options	19.531 kHz to 10 MHz
	N9030A/B with Option B25	19.531 kHz to 25 MHz
	N9030A with Options B1X or B1Y or B85 or B40 and Option MPB	19.531 kHz to 40 MHz
	N9030B with Options B85, RTS and RT1 or RT2	19.531 kHz to 85 MHz
	N9030B with Options B1X, RTS and RT1 or RT2	19.531 kHz to 160 MHz
	N9030B with Option B2X or B5X, RTS and RT1 or RT2	19.531 kHz to 255 MHz
	N9020A/B or N9010A/B with Option DP2	19.531 kHz to 10 MHz
	N9020A/B or N9010A/B with Option B25 and Option DP2	19.531 kHz to 25 MHz
	N9010A/B with Option B40 and Option MPB and Option DP2	19.531 kHz to 40 MHz
	N9020A/B with Options B1X or B1A or B85 or B40 and Option MPB and Option DP2	19.531 kHz to 40 MHz
Rohde & Schwarz	FSV with Option B17 and Option B70 and EX-IQ Box	19.531 kHz to 40 MHz
	FSVR with Option B17 and EX-IQ Box	19.531 kHz to 40 MHz
	FSW with Option B17 and Option B40 and EX-IQ Box	19.531 kHz to 40 MHz
	FSW with Option B17 and Option B80 and EX-IQ Box	19.531 kHz to 80 MHz
	FSW with Option B17 and Option B160 and EX-IQ Box	19.531 kHz to 160 MHz
Tektronix	RSA6000 Series with Option 05	19.531 kHz to 40 MHz, discrete†
	RSA6000 Series with Option 05 and Option 110	19.531 kHz to 110 MHz, discrete†
	RSA5000B Series with Option 65 and Option B25	19.531 kHz to 25 MHz, discrete†
	RSA5000B Series with Option 65 and Option B40	19.531 kHz to 40 MHz, discrete†
	RSA5000B Series with Option 65 and Option B85 or Option B85HD	19.531 kHz to 85 MHz, discrete†
	RSA5000B Series with Option 65 and Option B16X or Option B16XHD	19.531 kHz to 165 MHz, discrete†
	RSA5000A Series with Option 25	19.531 kHz to 25 MHz, discrete†
	RSA5000A Series with Option 40	19.531 kHz to 40 MHz, discrete†
	RSA5000A Series with Option 85	19.531 kHz to 85 MHz, discrete†
	RSA5000A Series with Option 110	19.531 kHz to 110 MHz, discrete†

Vendor	Compatible Spectrum Analyzer	Supported Acq BW
Anritsu	MS2090A wit Option 124 and Option 125 and MA25424A IQ Converter	36kHz to 20MHz, discrete†
	MS2090A wit Option 124 and Option 125 and Option 103 and MA25424A IQ Converter	36kHz to 50MHz, discrete†
	MS2090A wit Option 124 and Option 125 and Option 104 and MA25424A IQ Converter	36kHz to 110MHz, discrete†
	MS2090A wit Option 124 and Option 125 and Option 104 and Option 199 and MA25424A IQ Converter	36kHz to 110MHz, discrete†

†. The IQC5000 supports discrete acquisition bandwidths for the Tektronix RSA6000 and RSA5000, and the Anritsu Field Master Pro MS2090A Spectrum Analyzers. See “Acquisition Bandwidth” on page 30.

IQC5000 Controls and Indicators

Figure 2 IQC5000B/IQC-MEM Front Panel

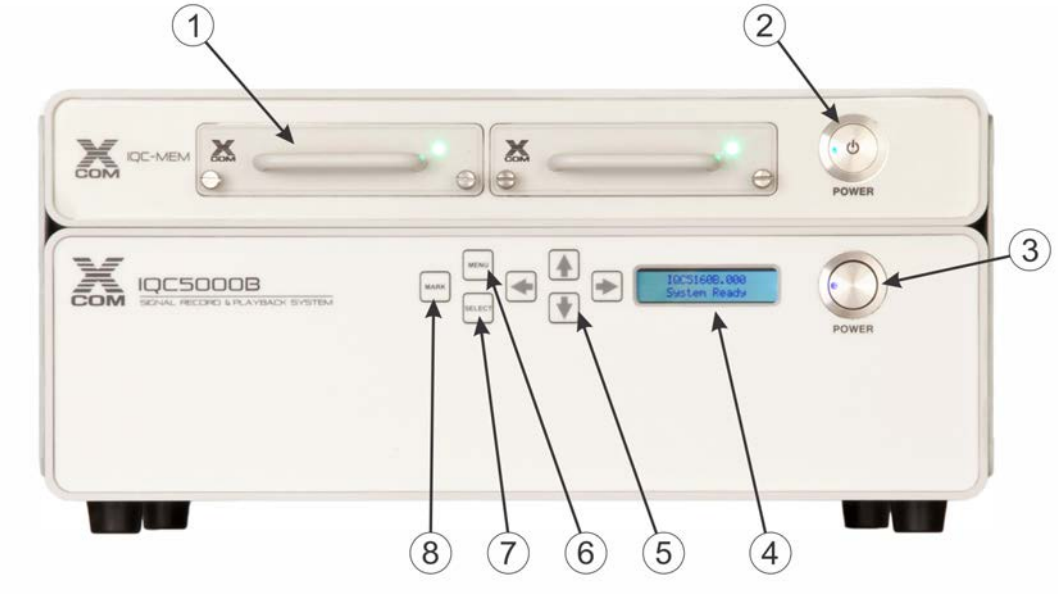


Table 5 - IQC5000B Front Panel Controls and Indicators

Item	Name	Description
1	IQC5000B-ME2	Internal RAID0 SSD disk storage: 2TB. Supports single channel operation up to 160 MHz bandwidth.
2	Power Pushbutton	Used to apply and remove power to the IQC-MEM unit.
3	Power Pushbutton	Used to apply and remove power to the IQC5000B.
4	Front Panel Display	Displays current mode and menu.
5	Directional Arrows	Used for navigating the front panel menus.
6	MENU	Enables the menu on the front-panel display.
7	SELECT	Selects available menu option.
8	MARK	Inserts a marker while recording.

Figure 3 IQC5000B/IQC-MEM Rear Panel

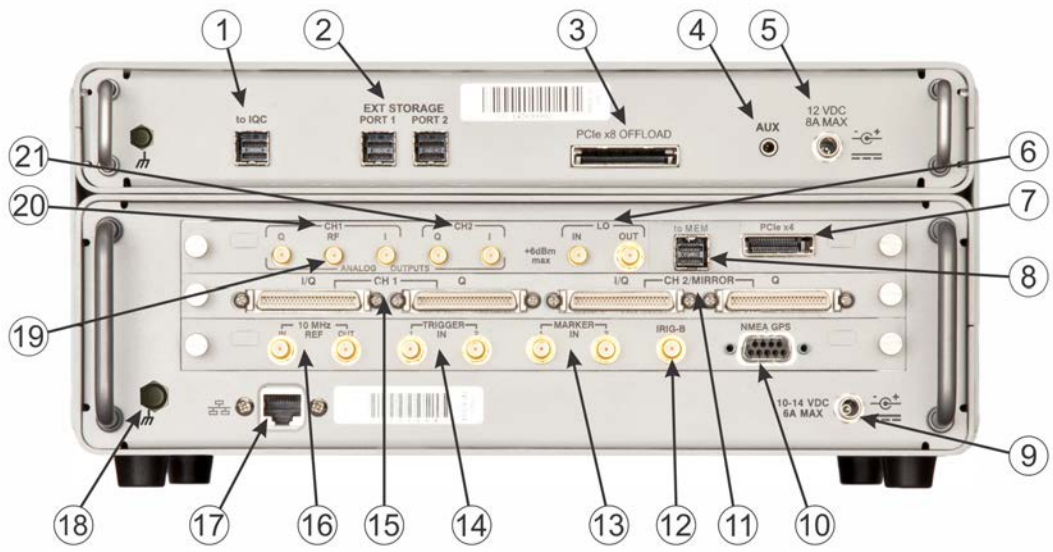
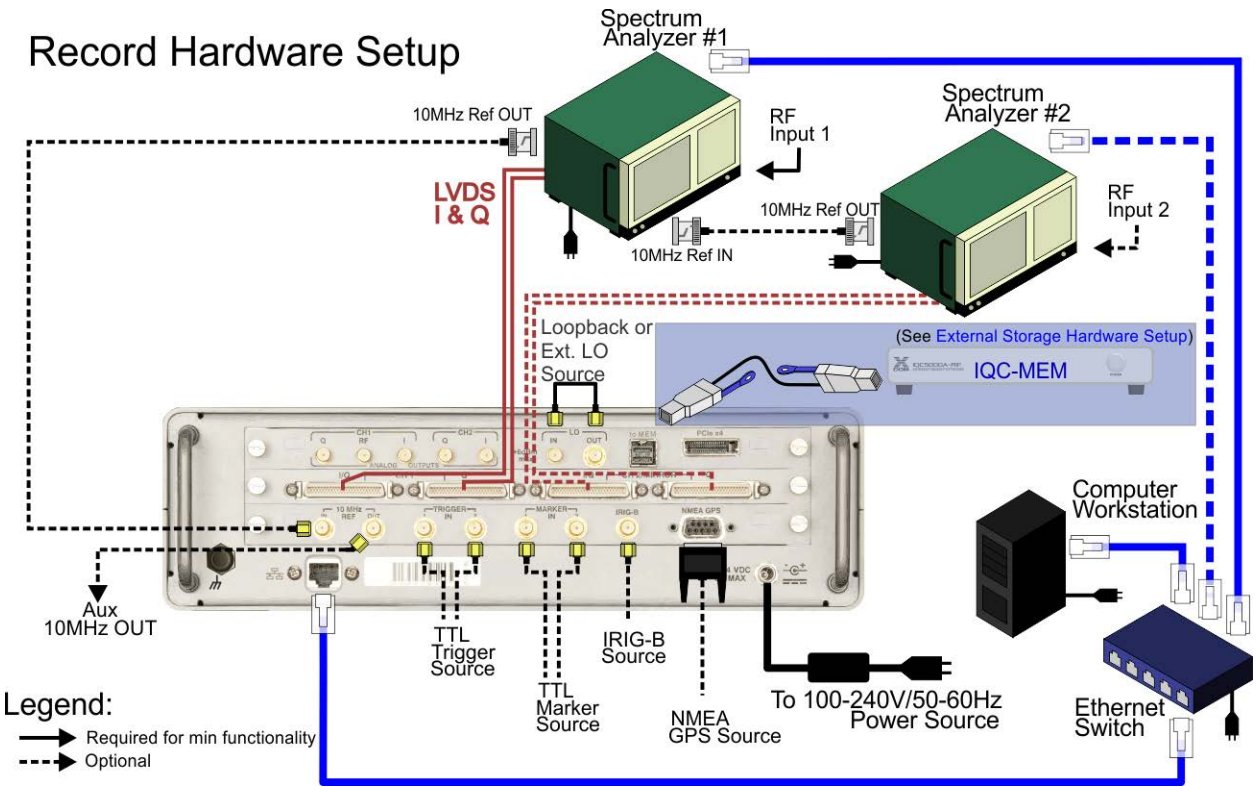


Table 6 - QC5000B Rear Panel Controls and Indicators

Item	Option	Connector	Description
1		Ext. MiniSAS HD	Cable connection for IQC5000B.
2		Ext. MiniSAS HD	Cable connection for external storage unit
3		Ext. MiniSAS HD	Cable connection for external storage unit
4		Aux Jack	
5		Power Jack	DC input power (12 VDC)
6		SMA (Jack)	Local Oscillator In/Out
7		4-Lane PCIe	PCI Express interface - not used on IQC5000B
8		Ext. MiniSAS HD	Cable connection for IQC-MEM unit. Record directly to external storage
9		Power Jack	DC input power (10-14 VDC)
10		DB-9 (Socket)	NMEA GPS (Input)
11	042,162	50 pin LVDS	Channel 2 I/Q digital input signals
12		SMA (Jack)	IRIG-B (Input)
13		SMA (Jack)	Marker 1, 2 input (1 - 3.3 VDC, 5 V Max)
14		SMA (Jack)	Trigger 1, 2 input (1 - 3.3 VDC, 5 V Max)
15		50 pin LVDS	Channel 1 I/Q digital input signals
16		SMA (Jack)	10 MHz Reference In/Out
17		RJ-45 Receptacle	10/100/1000 MB Ethernet interface
18		Threaded Nut	Ground lug
19	101	SMA (Jack)	Fixed frequency RF output
20	101	SMA (Jack)	Channel 1 I/Q Analog output signals
21	102	SMA (Jack)	Channel 2 I/Q Analog output signals

Hardware Setup – Record

Figure 4 Recording Hardware Setup



To set up the hardware for recording:

1. Connect the Power Cables to the following devices:
    a. IQC5000 (Note: requires 10-14V power adapter)
    b. Spectrum Analyzer (SA)
    c. Ethernet Switch
    d. Computer Workstation
    e. IQC-MEM (Note: requires 10-14V power adapter)
    f. (OPTION) External storage unit (s)
2. Connect the LVDS Data Cables from Spectrum Analyzer to IQC5000:
    Keysight X-Series (Narrowband Interface up to 40 MHz)
    a. Connect the wide end of the LVDS cable from the X-Series Digital Bus Out to the IQC5000 CH 1 I/Q Input
    Keysight X-Series (Wideband Interface up to 255 MHz)
    a. Connect from the X-Series I Out to the IQC5000 CH 1 I Input

b. Connect from the X-Series Q Out to the IQC5000 CH 1 Q Input

Rohde &Schwarz FSV/FSW

a. Mate the RSX adapter with the EX-IQ Z-Dok connector
b. Connect the wide LVDS cables from the RSX I and Q to the IQC5000 CH 1 I/Q Input
c. Connect the EX-IQ data cable from the EX-IQ IN port to the FSV/FSW Digital Baseband OUTPUT port
d. Connect a USB cable from the EX-IQ to the FSW running DigIConf.
e. Connect a BNC cable from the 10MHZ REF OUT on the FSV/FSW to the REF IN on the EX-IQ

Tektronix RSA

a. Connect from the RSA I Out to the IQC5000 CH 1 I Input.
b. Connect from the RSA Q Out to the IQC5000 CH 1 Q Input.

Anritsu Field Master Pro

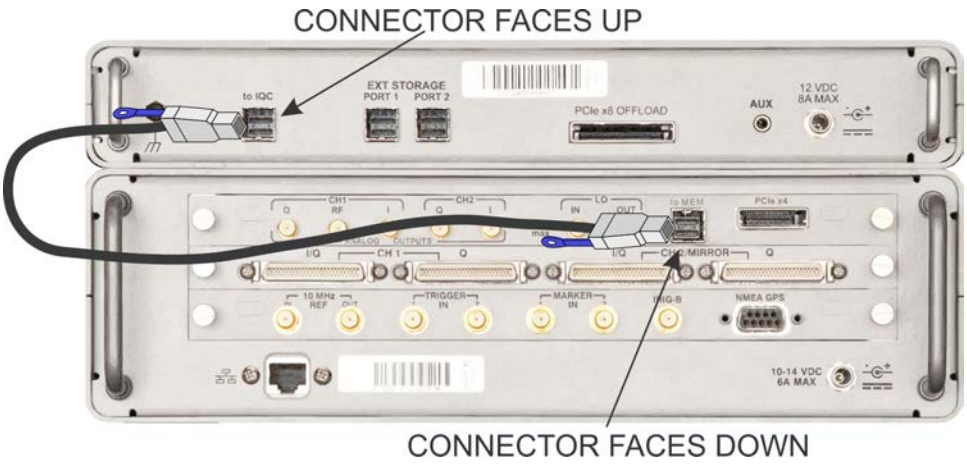
a. Connect PCIe cable from MS2090A to MA25424A IQ Converter
b. Connect USB cable from MS2090A to MA25424A IQ Converter
c. Connect MA25424A IQ Converter I Out to the IQC5000 CH 1 I Input
d. Connect MA25424A IQ Converter Q Out to the IQC5000 CH 1 Q Input

3. (Option: external storage) Connect cables for the IQC-MEM and external storage units.

CAUTION
Use extra care when connecting External MiniSAS HD connectors, the ports are keyed, but can be forced in upside-down.

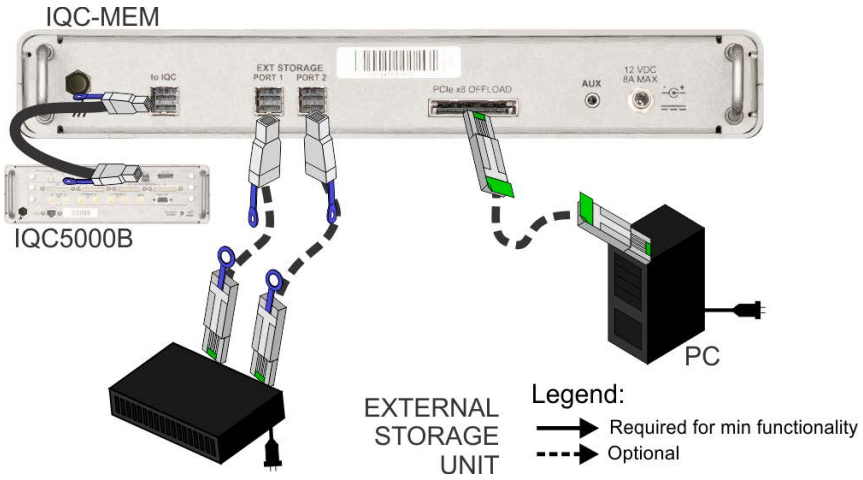
a. Connect the External MiniSAS HD to External MiniSAS HD cable to the IQC5000B to MEM port – with tab facing down – connect remaining end to the IQC-MEM to IQC port – with tab facing up.

Figure 5 IQC-MEM Cable Connection



b. Connect one end of the External MiniSAS HD cable to the IQC-MEM EXT STORAGE PORT 1, connect the remaining end to External Storage Unit data port.

Figure 6 IQC-MEM External Storage Cable Connections



c. (Option: 2-channel recording with ONE external SSD storage unit) Connect one end of the External MiniSAS HD cable to IQC-MEM EXT STORAGE PORT 2, and the remaining end of the cable to the External Storage Unit data port.

4. (Option: high-speed file transfer) Connect the PCIe Cables.
   (IQC-MEM) Connect the PCIe cable from the MEM PCIe x8 slot to the Computer Workstation.
5. Connect Ethernet cables from the Ethernet Switch to the following:
   a. IQC5000
   b. Spectrum Analyzer
   c. Computer Workstation
6. Connect the RF Cables:

CAUTION RF Connector Torque Ratings When mating RF connectors, ensure that they are properly aligned and not cross-threaded. Additionally, do not under/over torque RF connectors, as this could result in unreliable results, or worse, damaging the IQC5000. Always check manufacturer specification for proper torque ratings of all RF connectors. The table below defines the recommended torque ratings for RF connectors used within the IQC5000.	
RF Connector Type	Torque Rating (inch-pounds)
SMA	8.0

   a. Connect the RF signal source to the RF IN on the SA.
   b. (Recommended) Connect a 10MHz clock reference to the REF IN on the SA.
   c. (Recommended) Connect the REF OUT on the SA to the 10MHz REF IN on the IQC5000.

CAUTION Marker and Trigger Input Voltage Should Not Exceed 5V The operating range for the marker and trigger inputs is 1 to 3.3V DC. The input voltage should not exceed 5V, as this could result in damage to the IQC5000.

   d. (Option: triggers) Connect trigger source(s) to Trigger IN on the IQC5000.
   e. (Option: markers) Connect marker source(s) to Marker IN on the IQC5000 (connect NMEA 1PPS to Marker 1 if NMEA data is desired).

7. (Option) Connect the Time/Location Cables:
    a. (Option: for time/location-tagging) Connect a NMEA GPS source to the NMEA GPS input on the IQC5000. See "NMEA GPS Port Baud Rate Selection" on page 48.
    b. (Option: for precision time-tagging) Connect an IRIG-B122 source to the IRIG-B input on the IQC5000.
8. Power on the Units:
    a. (Option: External Storage Units) Power on External Storage Unit 1 and External Storage Unit 2.

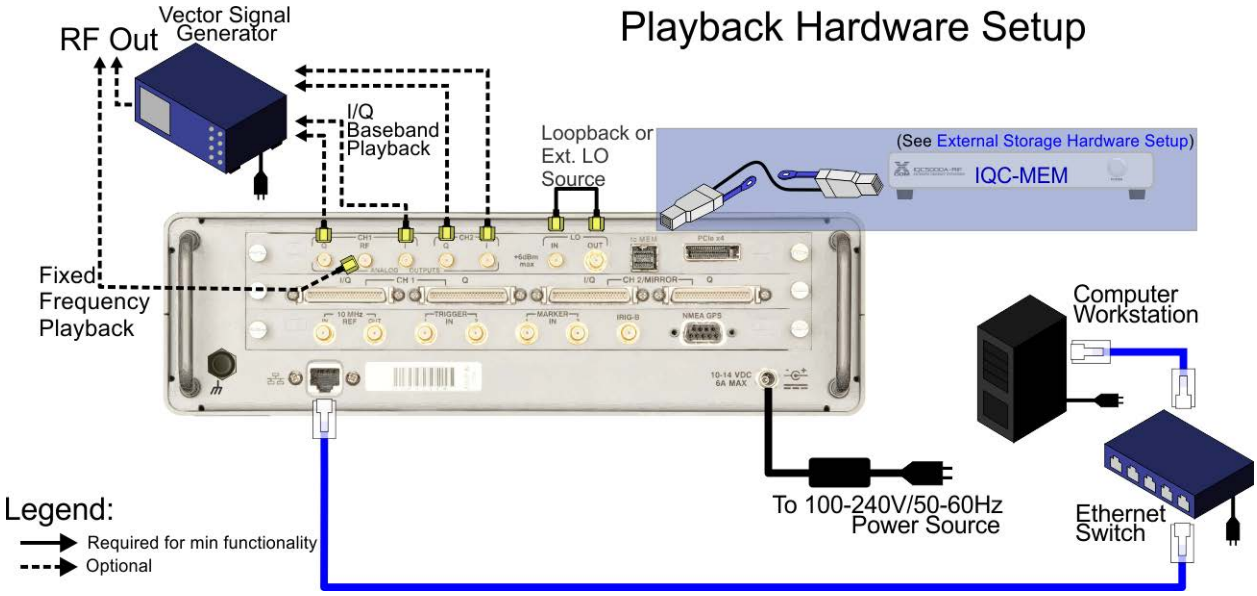
        Note: *Wait 15 seconds before continuing.*
    b. (IQC-MEM) Power on the MEM module.
    c. Power on in any order:
        - IQC5000
        - Spectrum Analyzer
        - Ethernet Switch

        Note: *If using PCIe offload, allow IQC to boot fully before powering on Computer Workstation.*
    d. Power on the Computer Workstation.

Hardware Setup – Playback

The IQC5000B is capable of I/Q baseband and RF playback. The I/Q Baseband playback is intended for normal use, RF playback capability should be used for testing and system validation only. Do not use RF Playback for normal use.

Figure 7 Playback Hardware Setup



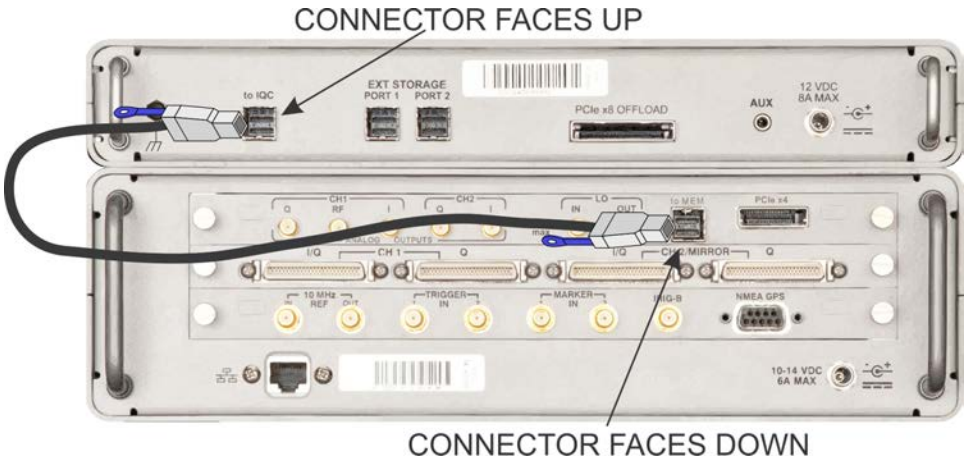
To playback, perform the following steps:

1. Connect the Power Cables to the following devices:
    a. IQC5000 (Note: requires 10-14V power adapter)
    b. Ethernet Switch
    c. Computer Workstation
    d. IQC-MEM (Note: requires 10-14V power adapter)
    e. (OPTION) External storage unit (s)
2. (Option: external storage) Connect cables for the IQC-MEM and external storage units.

CAUTION
Use extra care when connecting External MiniSAS HD connectors, the ports are keyed, but can be forced in upside-down.

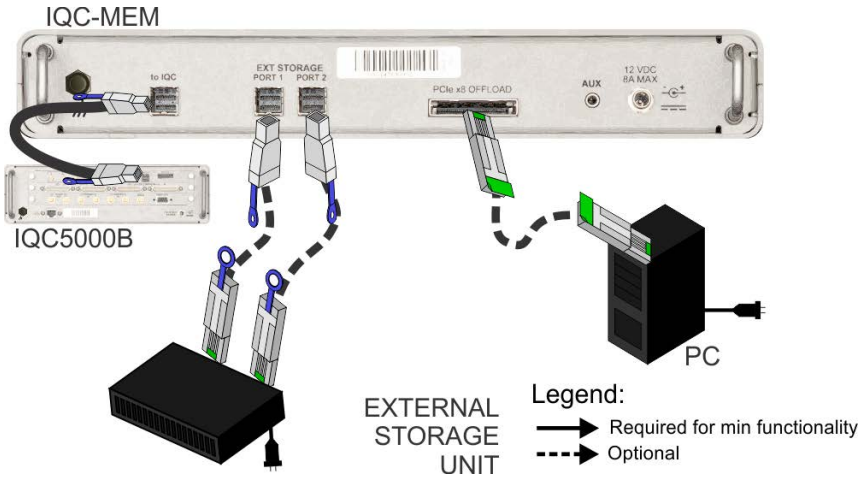
    a. Connect the External MiniSAS HD to External MiniSAS HD cable to IQC5000B to MEM port – with tab facing down – connect remaining end to the IQC-MEM to IQC port – with tab facing up.

Figure 8 IQC-MEM Cable Connection



b. Connect one end of the External MiniSAS HD cable to the IQC-MEM EXT STORAGE PORT 1, connect the remaining end to External Storage Unit 1 data port.

Figure 9 IQC-MEM External Storage Cable Connections



c. (Option: 2-channel recording with ONE external SSD storage unit) Connect one end of the External MiniSAS HD cable to IQC-MEM EXT STORAGE PORT 2, and the remaining end of the cable to the External Storage Unit data port.

3. Connect Ethernet cables from the Ethernet Switch to the following:
   a. IQC5000
   b. Computer Workstation
4. Determine whether an I/Q baseband or fixed frequency playback is desired.
   a. If I/Q baseband playback is desired go to Step 5.
   b. If fixed frequency playback is desired go to Step 6.

CAUTION RF Connector Torque Ratings When mating RF connectors, ensure that they are properly aligned and not cross-threaded. Additionally, do not under/over torque RF connectors, as this could result in unreliable results, or worse, damaging the IQC5000. Always check manufacturer specification for proper torque ratings of all RF connectors. The table below defines the recommended torque ratings for RF connectors used within the IQC5000.	
RF Connector Type	Torque Rating (inch-pounds)
SMA	8.0

5. I/Q Baseband Playback through a Vector Signal Generator (VSG):
    a. Connect the IQC5000 SMA analog I baseband output to the analog I baseband input on the VSG.
    b. Connect the IQC5000 SMA analog Q baseband output to the analog Q baseband input on the VSG.
    c. Connect an antenna or cable to the RF OUT of the VSG, and link it to the desired target.
    d. Connect power cable to the VSG.
    e. Power on the VSG.
    f. Configure the VSG to mix the I/Q signal and modulate it to the desired frequency.
6. Fixed Frequency Playback from the IQC5000:
    a. Connect the IQC5000 SMA RF output to the desired target.
7. Power on the Units:
    a. (Option: External Storage Units) Power on External Storage Unit 1 and External Storage Unit 2.

        Note: *Wait 15 seconds before continuing.*
    b. Power on the MEM module.
    c. Power on in any order:
        - IQC5000
        - Ethernet Switch

        Note: *If using PCIe offload, allow IQC to boot fully before powering on Computer Workstation.*
    d. Power on the Computer Workstation.

Network Setup

The IQC5000 is a network-controlled device, negotiable on a 10/100/1000 Mbps connection. The unit can be configured to a custom static IPv4 address and subnet mask.

The IQC5000 is shipped with an IP address of 192.168.2.200 and a subnet mask of 255.255.255.0. The IP address and subnet mask can be changed by using IQC Control and following the instructions outlined in "Changing the IQC5000 IP Address" on page 48 and "Changing the IQC5000 Subnet Mask" on page 48.

Perform the following steps to set up networking with the IQC5000:

1. For any firewall devices that may limit network port usage, white list the ports/protocols in Table 7.

Table 7 - Listening Ports and Protocols

Device Type	Vendor	Device/Software	Device Listening Port, Protocol
Record/Playback System	Bird	IQC5000	6644, TCP & UDP
Computer Workstation	Bird	IQC Control SCPI Command Server	6634, TCP & UDP
Spectrum Analyzer	Keysight	N9010A/B	5025, TCP
		N9020A/B	
		N9030A/B	
		N9040B	
Spectrum Analyzer	Rohde and Schwarz	FSV/FSW	5025, TCP
Spectrum Analyzer	Tektronix	RSA 5000 Series	4000, TCP
		RSA 6000 Series	
Spectrum Analyzer	Anritsu	MS2090A	9001, TCP
Auxiliary Software	Rohde and Schwarz	DigIConf	5026, TCP

2. Complete at least steps 1, 4, 5, 8c, and 8d of the Hardware Setup – Record Section.
3. If desired, change the IQC5000 network settings.

   The IQC5000 is shipped with an IP address of 192.168.2.200 and a subnet mask of 255.255.255.0. The IP address and subnet mask can be changed by using IQC Control and following the instructions outlined in "Changing the IQC5000 IP Address" on page 48 and "Changing the IQC5000 Subnet Mask" on page 48.
4. Configure the Computer Workstation to have a static IP address in the subnet of 192.168.2.X where the last octet X is not the same as the IQC5000 IP address (and is also not equal to 1, 254, or 255), with a subnet mask of 255.255.255.0.
5. Configure the Spectrum Analyzer with a static IP address in the subnet of 192.168.2.X where the last octet X is not the same as the IQC5000 or Workstation IP addresses (and is also not equal to 1, 254, or 255), with a subnet mask of 255.255.255.0.

Keysight X-Series Spectrum Analyzer Setup

Note: *Refer to the X-Series Operating Manual for more detailed instructions on signal analyzer operation. The following represents the minimum steps required to perform a recording with the IQC5000.*

Setting the IP Address

Setting the IP address on an X-Series spectrum analyzer follows the standard method of setting an IP address in Microsoft® Windows™.

Administrative Access

Before setting the IP address, you must gain administrative access. To do so, follow these steps:

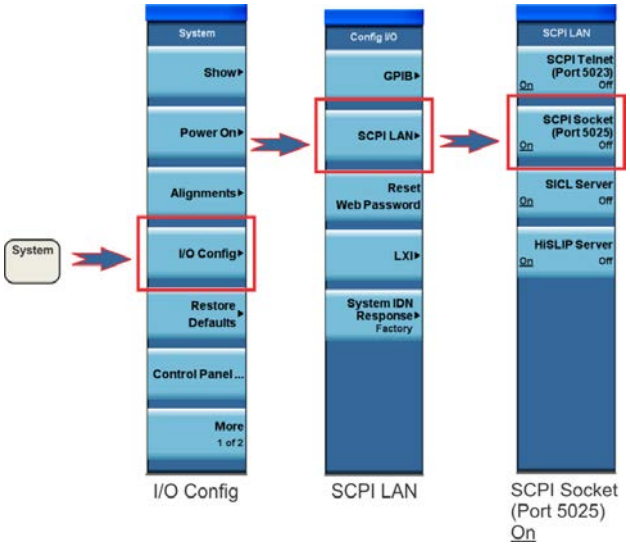
1. Log off user Instrument.
2. Log on as user administrator (no caps) with password Keysight4u! (agilent4u for Analyzers labeled Agilent).
3. Set the IP address as outlined in "Network Setup" on page 15.
4. Log off user administrator and log back on as user Instrument.

Turning on the SCPI Socket Server

The SCPI socket server must be running on the X-Series to record. Follow these steps:

1. Press System on the front panel.
2. Press IO Config > SCPI LAN > SCPI Socket (Port 5025) On.

Figure 10 SCPI Socket Server



Hardware Alignment

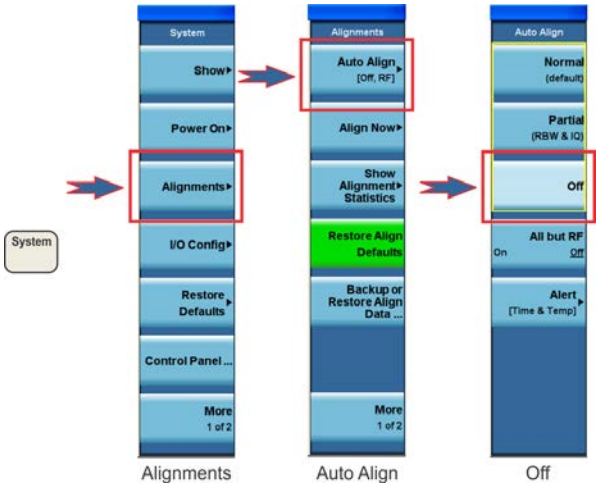
Note: *The alignment mode should not be set to automatic, else the I/Q streaming data is interrupted by an automatic calibration. Alignment should be performed after a 20-minute warm-up, and immediately before recording for best results.*

To set Hardware Alignment from Automatic to Manual:

1. Press System on the front panel.

Press Alignments > Auto Align > Off.

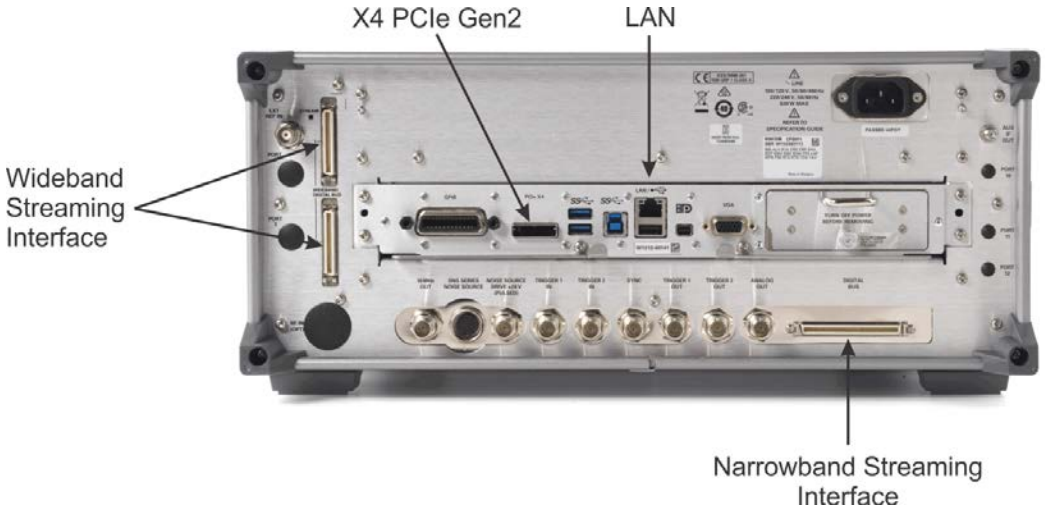
Figure 11 Alignment Mode



Keysight Operation

The Keysight family of X-Series signal analyzers offer two different digital IQ streaming interfaces. One is for wideband streaming and one is for narrowband. The N9040B and N9030B provide up to 255 MHz of digital IQ streaming when equipped with options B2X or B5X, RTS and RT1 or RT2. They provide up to 160 MHz of digital IQ streaming when equipped with options B1X, RTS and RT1 or RT2. The wideband interface streams I and Q data via separate 50 pin LVDS connectors. Without option RTS, the N9040B and N9030B and the rest of the X-Series analyzers stream up to 40 MHz of IQ bandwidth through an 80 pin narrowband LVDS connector shown below, provided the signal analyzer is equipped with option B40.

Figure 12 Keysight N9030B Signal Analyzer Rear Panel



Each of the Keysight X-Series analyzers allow IQC Control to be run on the desktop of the signal analyzer. This has the benefit of eliminating the need for an external PC. The Keysight analyzers also include x4 PCIeGen2 interface allowing IQ data to be offloaded from the IQC5000B into the internal PC of the X-Series analyzer.

Note: *Optionally, an external USB 3.0 drive may be used to offload data to or from the analyzer*

Rohde and Schwarz FSV/FSW

Note: *Refer to the FSV or FSW Operating Manual for more detailed instructions on signal analyzer operation. The following represents the minimum steps required to perform a recording with the IQC5000.*

Setting the IP Address

To set the IP address of the FSV/FSW:

1. Press Setup on the front panel.
2. Press Network + Remote.
3. In the IP Address field, enter the desired IP address, or alternatively select Open Dialog “Network Configuration” to bring up the Microsoft Network Configuration menu.
4. Set the IP address as outlined in "Network Setup" on page 15.

Configure Windows Firewall on the FSV/FSW to Allow DigIConf Traffic

The Windows Firewall needs to be configured on the FSV/FSW to allow DigIConf traffic from the Computer Workstation to the FSV/FSW. To configure the firewall:

1. Navigate to Control Panel > Windows Firewall > Advanced Settings > Inbound Rules.
2. Select New Rule.
3. Select Port and click Next.
4. Select to apply this rule to TCP traffic on specific local port 5026 and click Next.
5. Select Allow the Connection and click Next.
6. Select to apply this rule to Domain, Public, and Private interfaces and click Next.
7. Name the rule DigIConf and click Finish.

(Optional) Running DigIConf on Another Machine

DigIConf software by default is set to run on the FSV/FSW, so that the IQC5000 system can interface with the EX-IQ (this default setup is highly recommended). If desired, DigIConf may be installed on a workstation, and the EX-IQ may be attached to and controlled by that workstation. The following instructions detail how to configure DigIConf on a workstation.

Installing DigIConf

To install the DigIConf software, run the installer included on the EX-IQ software disc. You will be prompted to accept the End-User License Agreement, as well as to accept the installation of various drivers. The DigIConf software must be version 03.01.009.30 or higher.

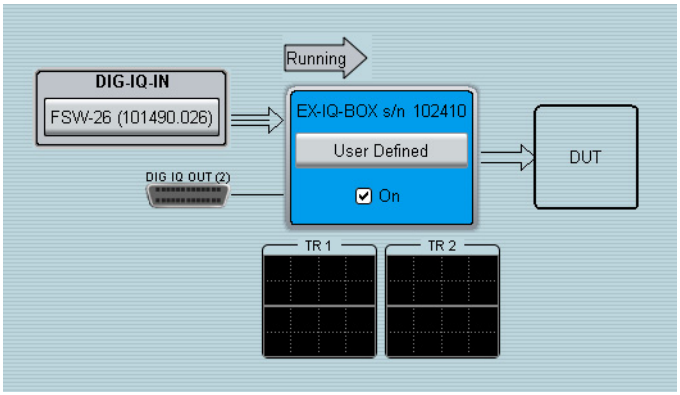
Running DigIConf

Ensure the hardware is connected according to the steps outlined in "Hardware Setup – Record" on page 8 with the exception of the EX-IQ connected via USB to the desired workstation. Once the hardware setup is complete:

1. Start the DigIConf software.
2. Start IQC Control and add a remote device for the FSV/FSW.
3. Set the IP address for DigIConf within the remote device menu to the IP address of the workstation. Use the loopback address of 127.0.0.1 if running locally. (See "Connecting/Disconnecting to a Remote Device" on page 50 and "Managing Remote Devices" on page 51 for more details.)

The Setup Diagram shown in the program menu should reflect the hardware setup:

Figure 13 DigIConf Setup Diagram



No further configuration of DigIConf is required. The IQC Control software will automatically configure the rest.

Tektronix RSA6000 Series

Note: *Refer to the Tektronix RSA6000B Operating Manual for more detailed instructions. The following steps are intended to provide a quick setup of record-specific settings.*

It is recommended that a saved setup be made after completing the necessary steps for recording. A saved setup file can be set to a user preset, so that the setup can be quickly recalled.

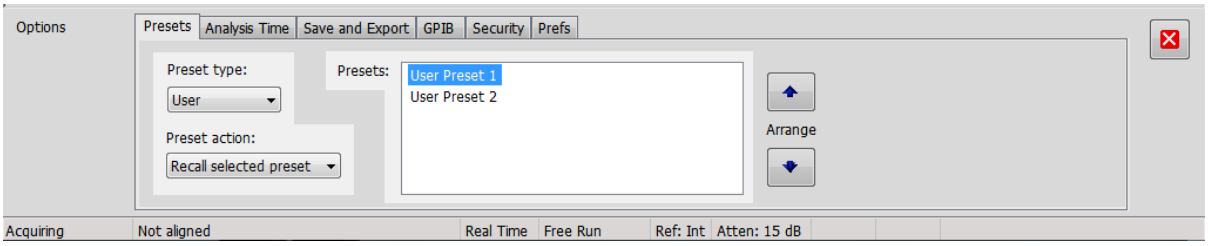
Note: *Settings in the Config In/Out menu on the RSA are not reset by a preset. These settings will need to be checked after recalling a saved setup.*

Save a Setup

To save a setup as a user preset on the RSA:

1. Go to File > Save As…
2. Navigate to C:\RSA6100B Files\User Presets and select to save as type Setup file.
3. Go to Tools > Settings > Presets, and then select User from the drop-down Preset type. See Figure 14.
4. The new preset should show in the preset listing. If it is not at the top of the list, select it and then press the Up button on the right of the list to move it to the top.
5. Select Recall selected preset from the drop-down Preset action.

Figure 14 Tektronix Presets

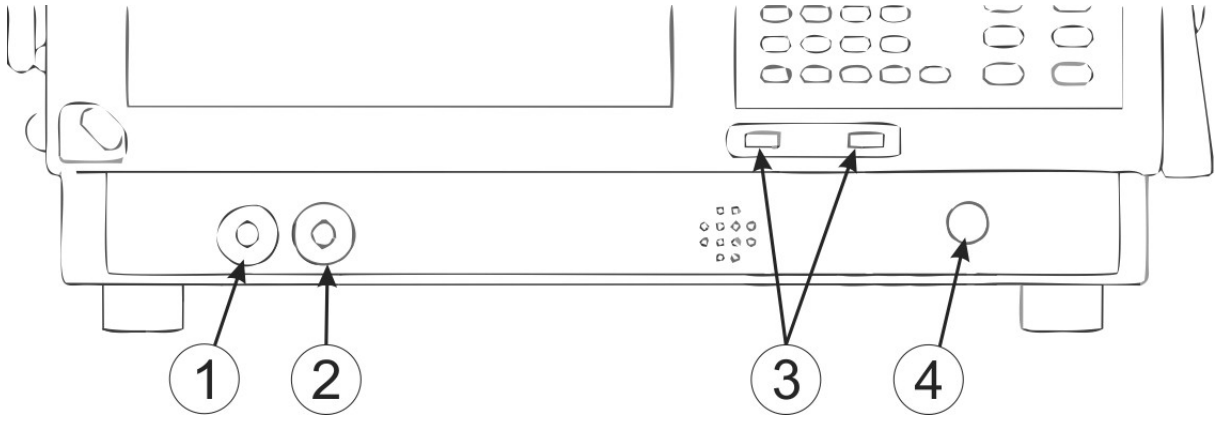


The preset can now be activated any time by pressing the User button on the front panel, in the Presets block.

Connection Points

This section describes the input and output connectors on the Tektronix RSA6000 spectrum analyzer. For more information on the spectrum analyzer, reference the Tektronix RSA Operating Manual.

Figure 15 Tektronix RSA Front Panel

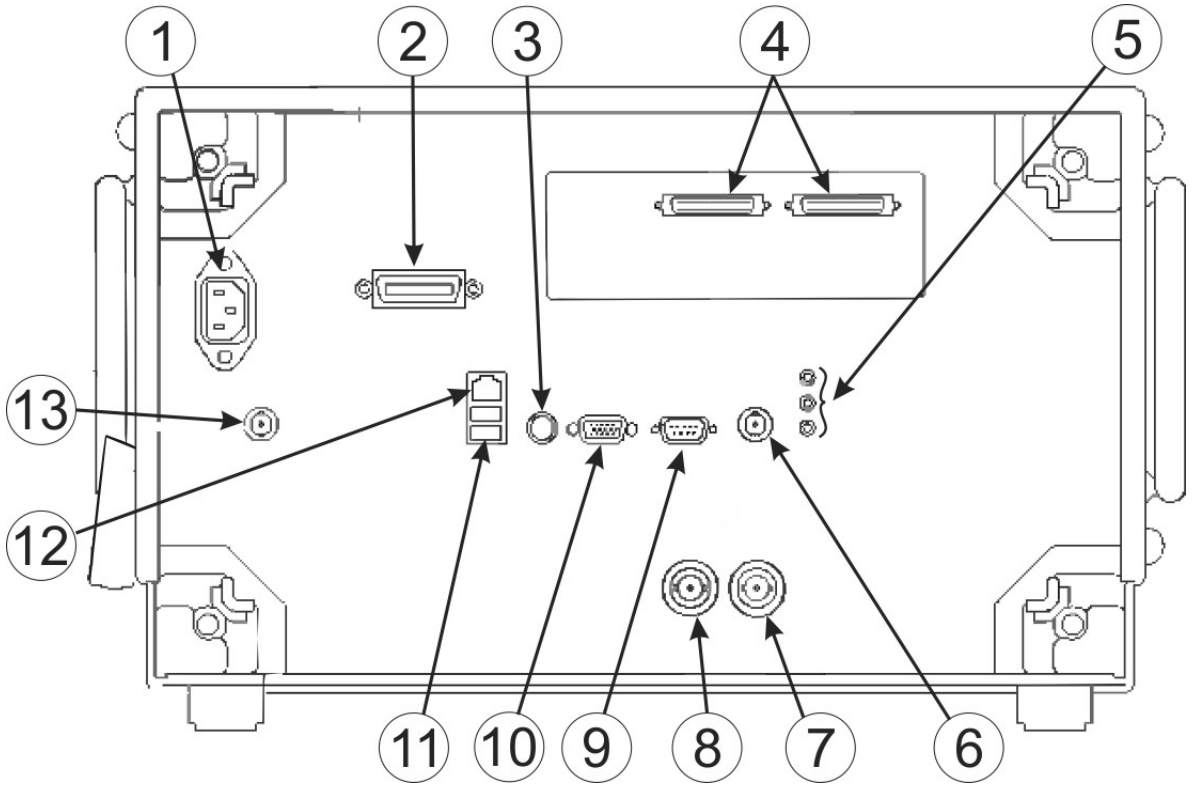


The following is a description of the front-panel controls on the RSA.

Table 8 - Tektronix RSA Front Panel Connectors

Item	Label	Description
1	Trig Out	Trigger output connector. 50 Ohm, BNC, High > 2.0 V, Low < 0.4 V
2	Trig In	External Trigger input connector, –2.5 V to +2.5 V range
3	USB Ports	USB 2.0 connector
4	RF Input	RF input connector 50 Ohm, +30 dBm input maximum

Figure 16 Tektronix RSA Rear Panel



The following is a description of the rear-panel connection points on the RSA.

Table 9 - Tektronix RSA Rear Panel Connectors

Item	Description
1	AC Input, main power connector
2	GPIB
3	PS2 Keyboard input
4	Real Time IQ Out (Option 05)
5	Microphone in; Headphone, audio output; and Line In connectors
6	External Trigger 2 Input
7	Ref In, reference frequency input
8	Ref Out, reference frequency output
9	COM 2, serial port for connecting peripherals
10	VGA external monitor output (resolution not limited to VGA)
11	USB 2.0 ports for mouse and other peripherals (printers, external hard disks)
12	LAN, Ethernet network connector
13	+28 VDC output, switched

Setting the IP Address

Setting the IP address on the RSA follows the standard method of setting an IP address in Microsoft® Windows Vista™ or Microsoft® Windows 7™, depending on the operating system installed on the RSA.

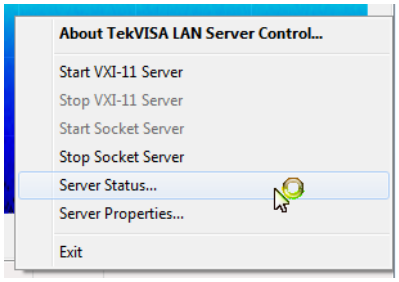
Set the IP address as outlined in "Network Setup" on page 15.

Turning On the SCPI Socket Server

The SCPI socket server must be running on the RSA for recording. Follow these steps:

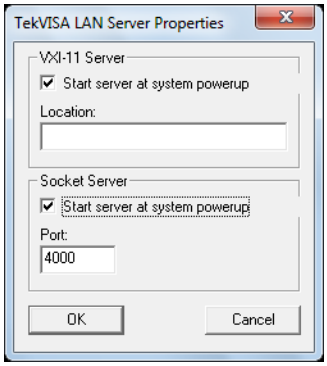
1. Right-click on the TekVISA LAN Server Control icon in the system tray: 
2. Select Server Status from the menu that appears:

Figure 17 TekVisa Server Control Menu



3. Click the Start Socket Server button in the upper-right corner.
4. To start the socket server during power-on of the RSA, click Server Properties as seen in Figure 17. Next, under the Socket Server section, click the check box Start server at system powerup (see Figure 18):

Figure 18 TekVisa LAN Server Properties



Hardware Alignment

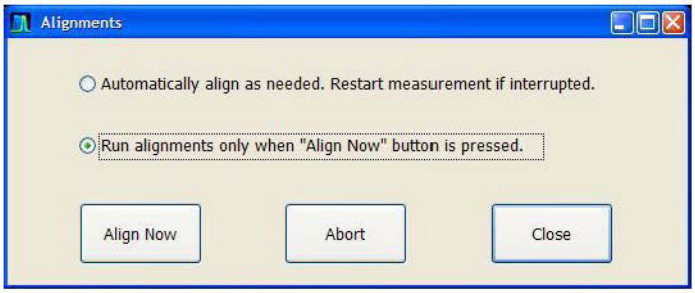
> **Note:** *The alignment mode should not be set to automatic, else the I/Q streaming data is interrupted by an automatic calibration. Alignment should be performed after a 20-minute warm-up, and immediately before recording for best results.*

To set Hardware Alignment from Automatic to Manual:

1. Go to Tools > Alignments.

2. Select the Run alignments only when “Align Now” button is pressed option.
3. Select Align Now to perform alignment.

Figure 19 Alignments Dialog Box

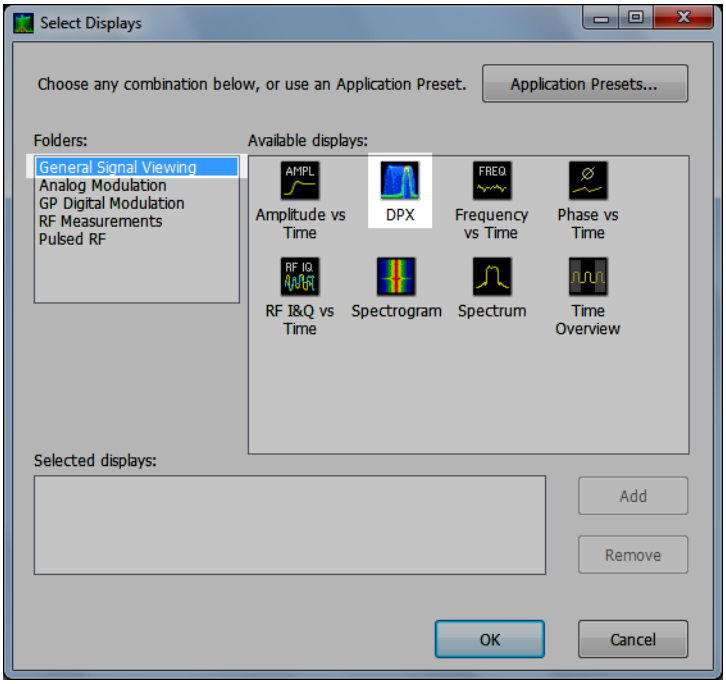


Enable DPX Display

The DPX display must be enabled to record data from the RSA. It is recommended that only the DPX display is enabled during recording to minimize processing conflict. To enable the DPX display:

1. Press the Displays button on the front of the RSA.

Figure 20 Tektronix Select Displays Dialog Box



2. Verify that General Signal Viewing is selected under Folders.
3. Double-click DPX under Available Displays.

Anritsu Field Master Pro MS2090A

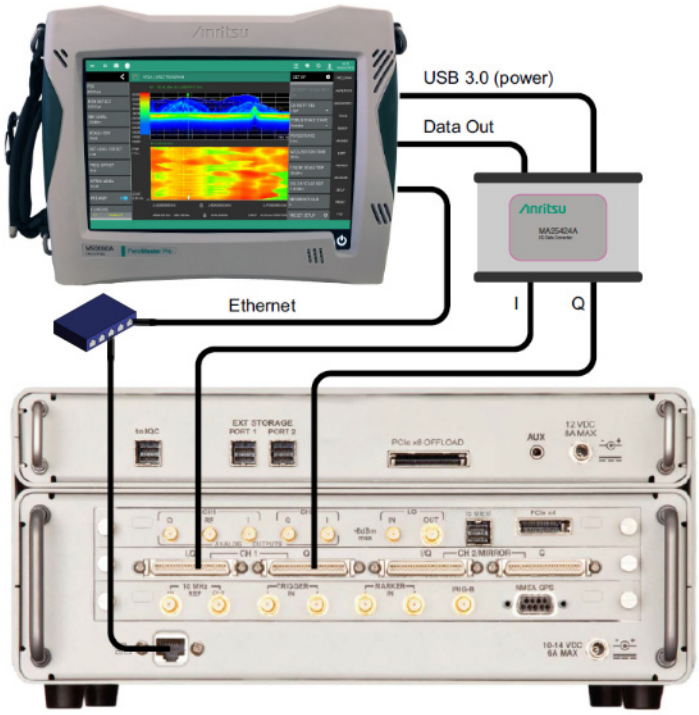
Refer to the Anritsu Field Master Pro MS2090A User Guide for detailed instructions on setup and configuration of the MS2090A.

The control software for the IQC5000B, IQC Control, controls the IQ streaming operation via the Ethernet connection to the MS2090A.

The MS2090A Data Out and USB ports connect to the MA25424A Data In and USB ports (note that the USB port is used for power and this could come from any external USB 3.0 power supply capable of supplying ~4 W).

The MA25424A splits the I and Q signal components to the two respective I and Q output ports (IEEE 1284-C) and streams the data to the IQC5000B I and Q input ports.

Figure 21 Anritsu Connection Diagram



Chapter 3 Operating Instructions

Starting and Stopping the System

Some of the devices within the IQC5000 system setup must be connected and powered on and off in a certain order. All steps that must be performed in a particular order are noted below:

> **Note:** *When using the PCIe cable connection between the IQC5000 and the Computer Workstation, the IQC5000 must be powered on before the Computer Workstation is powered on, and it must be powered off after the Computer Workstation is powered off. PCIe is generally not plug-and-play – a crash of the Microsoft® Windows™ OS on the Computer Workstation may occur if the IQC5000 is powered off while connected to it via PCIe.*
>
> **Note:** *When using IQC- MEM, there is a specific order for powering on the systems (after all connections have been made) that must be observed. First, power on the external storage unit (s) and wait 15 seconds. Next, turn on the IQC-MEM module. Lastly, turn on the IQC5000.*

The Ethernet Switch, Spectrum Analyzer and peripherals may all be turned off or restarted when not recording or playing back.

When the Power button is pressed on the front of the IQC5000, a blue LED will light and the front panel will display Loading. The IQC5000 will take approximately 10 seconds to initialize. When it is ready, it will display IQC5000 System Ready.

Follow the instructions in Chapter 2, Setup to power on the system

- Recording Power On: Step 8 on page 11.
- Playback Power On: Step 7 on page 14.

To power off the system, simply follow the power-on steps in reverse.

Using the IQC5000 Front Panel

Only select settings are exposed for configuration using the front panel. For full control of the IQC5000, use the IQC Control software. See "Using IQC5000 with IQC Control" on page 37.

Viewing the NIC Parameters

Perform the following steps to view the Network Interface Card parameters of the IQC5000:

1. Press the Menu button.
2. Press the right arrow button until NIC Parameters shows on the front panel display.
3. Press the down arrow to scroll through the NIC parameters.

The NIC parameters of the IQC5000 include:

- IP Address – the IP address of the IQC5000, settable via IQC Control (see "Changing the IQC5000 IP Address" on page 48).
- UDP Port number – the port number used to communicate with the IQC5000.
- Subnet Mask –the subnet mask of the IQC5000, settable via IQC Control (see "Changing the IQC5000 Subnet Mask" on page 48).
- Gateway – the default gateway of the IQC5000.

- Instrument IP Address – the IP address of the spectrum analyzer connected to the IQC5000, settable via IQC Control (see "Adding a Remote Device" on page 49).
- Instrument Port Number – the port number of the spectrum analyzer connected to the IQC5000, settable via IQC Control (see "Adding a Remote Device" on page 49).

Setting the Sample Rate Selection

Certain processes are optimized for recording using a sample rate greater than 120MHz with the Tektronix RSA6000. To set the sample rate mode:

1. Press the Menu button.
2. Press the right arrow button until Sample Rate Select shows on the front panel display.
3. Press the down arrow until the sample rate selections show:
    a. 120MHz OR GREATER
    b. LESS THAN 120MHz
4. Press the Select button to choose the appropriate sample rate mode.

Operational Overview

The IQC5000 records and plays back RF signals.

The following devices are used for recording and playback:

- IQC5000: The main system controller during record/playback. Starts and stops record/playback, marks data with time/location, writes data to storage during recording, converts digital data to analog I/Q and RF during playback.
- Spectrum Analyzer: Digitizes the RF data and streams it to the IQC5000. Also used to graphically view the RF spectrum in real-time or near real-time.
- Storage Media/Controllers
    - IQC5000B-MEM Module: The IQC-MEM is a storage controller capable of writing to internal removable SSD RAID storage units, or to external RAID0 storage units.
    - External Storage: Enclosure containing disk drives formatted with industry-standard RAID0 striping to increase write speed.
- Computer Workstation: Used to control the IQC5000 through the IQC Control software or API. Also provides the destination for offloaded data.
- Ethernet Switch: Provides network interconnection for IQC5000, Spectrum Analyzer, and Workstation.
- Vector Signal Generator: Converts analog baseband I/Q from the IQC5000 to RF during playback. Necessary if an arbitrary center frequency or other RF functions are desired.
- IRIG/GPS Source(s): Provide(s) time and location data for markers during recording.

See Chapter 2 "Setup" on page 8 for instructions on setting up the IQC5000 to record or playback.

Controlling the IQC5000

The IQC5000 can be controlled in two possible ways:

- IQC Control Software User Interface: IQC Control Software on the Computer Workstation is the primary method of control for the IQC5000. See "Using IQC5000 with IQC Control" on page 37.
- Command Server/API: A network sockets server runs in the background while IQC Control is running, and can be used to programmatically interface with the IQC5000 and connected devices using a SCPI-like language. See the IQC5000 API Programming Manual.

Record (Capture, Acquisition)

IQC5000B Storage

The IQC5000B-MEM module supports reading/writing to external storage as well as reading/writing to internal, removable drive cartridges.

Table 10 - IQC5000B-MEM Supported Storage Options

IQC5000B IQC-MEM		
	Internal SSD Drives	**External SSD Drives**
Storage Medium	One or two removable drive cartridges	1 externally connected enclosure, with 16 drives
Memory Depth Configurations	2000 GB each	8TB or 15TB enclosure
Max Number of Files	10^{18}	
Supported Data Rates	Up to 800 MB/s per cartridge	Up to 1600 MB/s
Supported # of Record/ Playback Channels	One with one cartridge installed OR one or two with two cartridges installed	One or two †
File System	ext4	
Volume Format	mdadm RAID0	

†. Two channel recording with external SSD storage enclosures requires using two MiniSAS cables to connect the main enclosure to the IQC5000B-MEM

Steps to Record

The high-level steps to record with the IQC5000 are:

1. Set up the hardware - follow steps in "Hardware Setup – Record" on page 8.
2. Set up the network - follow steps in "Network Setup" on page 15.
3. Set up the spectrum analyzer - follow steps in Spectrum Analyzer setup for your spectrum analyzer type.
4. Identify signal of interest on spectrum analyzer.
5. Set up the desired record method - follow one of the choices below:
   - User Interface - follow steps in "Recording with IQC Control" on page 53.
   - Command Server/API – see the IQC5000 API Programming Manual.
6. Modify center frequency, input power settings, and acquisition bandwidth.
7. Record.

Record Equations

The following equations are calculated by the IQC Control UI and API, and are listed here for reference:

Calculate Remaining Record Time Available

To calculate the remaining length of time available for a recording (in seconds), take the remaining storage in bytes and divide by the data rate in bytes/second for the corresponding spectrum analyzer acquisition bandwidth. See "Acquisition Bandwidth" on page 30.

Remaining Record Time (s) =

Storage Remaining (bytes) ÷ Data Rate for Acq BW (bytes/second)

Calculate Recording File Length of Time

The same formula applies for calculating the length in time of a recording:

Recording File Length of Time (s) =

File Length (bytes) ÷ Data Rate for Acq BW (bytes/second)

Record Start/Stop Methods

Using the IQC Control software UI or API, the following recording start/stop methods are available.

Table 11 - Record Start and Stop Methods

Record Type		Start	Stop
Basic	Manual	Immediate (Manual)	Immediate (Manual)
	Duration	Immediate (Manual)	Duration
Advanced – any combination of start/stop methods is possible		Immediate (Manual)	Immediate (Manual)
		Time of Day	Time of Day
		Trigger	Trigger
			Duration

Following is a brief description of the possible record start/stop methods:

- Immediate (Manual) (start and/or stop) – starts/stops a recording immediately on user input.
- Time of day (start and/or stop) – starts/stops a recording at a specified time of day.
- Trigger (start and/or stop) – starts/stops a recording based on trigger parameters.
  - 2 TTL-level trigger inputs
  - Rising or Falling edge
- Duration (stop only) – records for a specified duration of time or samples

Acquisition Bandwidth

The Acquisition Bandwidth, Recording Bandwidth, or Recording Span all refer to the instantaneous bandwidth that will be recorded. With a center frequency at 400 MHz, a 10 MHz acquisition bandwidth would record all signals ± 5 MHz from 400 MHz (395 to 405 MHz).

Keysight and Rohde & Schwarz recordings are capable of arbitrary acquisition bandwidths below their max supported span, down to 19.531kHz. Tektronix RSA and Anritsu Field Master Pro recordings are set to discrete acquisition bandwidths according to set sample rates.

Table 12 - Tektronix RSA6000 Discrete Acquisition Bandwidths Supported by the IQC5000

I/Q Sampling Rate (Sps)	Data Rate (Bytes/s)	RSA6000 Acq BW (Hz)	SR/Acq BW Divisor	Highest Option Required
150,000,000	600,000,000	110,000,000	1.3636	110, 05
75,000,000	300,000,000	60,000,000	1.2500	110, 05
50,000,000	200,000,000	40,000,000	1.2500	05
25,000,000	100,000,000	20,000,000	1.2500	05
12,500,000	50,000,000	10,000,000	1.2500	05
6,250,000	25,000,000	5,000,000	1.2500	05
3,125,000	12,500,000	2,500,000	1.2500	05
1,562,500	6,250,000	1,250,000	1.2480	05
781,250	3,125,000	625,000	1.2500	05
390,625	1,562,500	312,500	1.2500	05
195,312.5	781,250	156,250	1.2500	05
97,656.25	390,625	78,125	1.2501	05
48,828.125	195,313	39,062	1.2501	05
24,414.0625	97,656.25	19,531	1.2499	05

Table 13 - Tektronix RSA5000B Discrete Acquisition Bandwidths Supported by the IQC5000

I/Q Sampling Rate (Sps)	Data Rate (Bytes/s)	RSA5000B Acq BW (Hz)	SR/Acq BW Divisor	Highest Option Required
200,000,000	800,000,000	165,000,000	1.2121	B16X or B16XHD
200,000,000	800,000,000	85,000,000	2.3529	B85 or B85HD Only
100,000,000	400,000,000	80,000,000	1.2500	B85 or B85HD
50,000,000	200,000,000	40,000,000	1.2500	B40
25,000,000	100,000,000	20,000,000	1.2500	B25
12,500,000	50,000,000	10,000,000	1.2500	B25
6,250,000	25,000,000	5,000,000	1.2500	B25
3,125,000	12,500,000	2,500,000	1.2500	B25
1,562,500	6,250,000	1,250,000	1.2500	B25
781,250	3,125,000	625,000	1.2500	B25
390,625	1,562,500	312,500	1.2500	B25
195,312.5	781,250	156,250	1.2500	B25
97,656.25	390,625	78,125	1.2500	B25
48,828.125	195,313	39,062	1.2500	B25
24,414.0625	97,656.25	19,531	1.2500	B25

Table 14 - Tektronix RSA5000A Discrete Acquisition Bandwidths Supported by the IQC5000

I/Q Sampling Rate (Sps)	Data Rate (Bytes/s)	RSA5000A Acq BW (Hz)	SR/Acq BW Divisor	Highest Option Required
150,000,000	600,000,000	165,000,000 (Opt. 110) 85,000,000 (Opt. 85)	1.3636 (Opt. 110) 1.7647 (Opt. 85)	110 (Opt. 110) or 85 (Opt. 85)
75,000,000	300,000,000	60,000,000	1.2500	110 or 85
37,500,000	150,000,000	30,000,000	1.2500	110 or 85
50,000,000	200,000,000	25,000,000	2.0000	25
25,000,000	100,000,000	20,000,000	1.2500	25
12,500,000	50,000,000	10,000,000	1.2500	25
6,250,000	25,000,000	5,000,000	1.2500	25
3,125,000	12,500,000	2,500,000	1.2500	25
1,562,500	6,250,000	1,250,000	1.2500	25
781,250	3,125,000	625,000	1.2500	25
390,625	1,562,500	312,500	1.2500	25
195,312.5	781,250	156,250	1.2500	25
97,656.25	390,625	78,125	1.2500	25
48,828.125	195,313	39,062	1.2500	25
24,414.0625	97,656.25	19,531	1.2500	25

Table 15 - Anritsu MS2090A Acquisition Bandwidths Supported by the IQC5000

I/Q Sampling Rate (Sps)	Data Rate (Bytes/s)	MS2090A Acq BW (Hz)	SR/Acq BW Divisor	Highest Option Required	
				Spectrum Analyzer Mode	Real Time Spectrum Analyzer Mode
200000000	800000000	110000000	1.818181818	Option 104	Option 199 and Option 104
122880000	491520000	100000000	1.2288	Option 104	
100000000	400000000	80000000	1.25	Option 104	Option 199 and Option 104
92160000	368640000	74000000	1.245405405	Option 104	
61440000	245760000	50000000	1.2288	Option 103	
50000000	200000000	40000000	1.25	Option 103	Option 199 and Option 103
46080000	184320000	36000000	1.28	Option 103	
30720000	122880000	25000000	1.2288	Option 103	
25000000	100000000	20000000	1.25	None	Option 199
23040000	92160000	18000000	1.28	None	
15360000	61440000	12000000	1.28	None	
12500000	50000000	10000000	1.25	None	Option 199
7680000	30720000	6000000	1.28	None	
6250000	25000000	5000000	1.25	None	Option 199
3840000	15360000	3000000	1.28	None	
3125000	12500000	2500000	1.25	None	Option 199
1920000	7680000	1500000	1.28	None	
1562500	6250000	1250000	1.25	None	Option 199
360000	1440000	280000	1.285714286	None	
45000	180000	36000	1.25	None	

Playback

The IQC5000B is capable of I/Q baseband and RF playback. The I/Q Baseband playback is intended for normal use, RF playback capability should be used for testing and system validation only. Do not use RF Playback for normal use.

The IQC5000 is capable of playing back 2 channels of analog I/Q baseband waveforms, and 1 channel at RF. Using the IQC Control software, the following playback options are available:

- Partial file playback
- Looped file playback
- RF fixed frequency playback at 2.4GHz
- Analog I/Q Playback

Steps to Playback

The high-level steps to playback with the IQC5000 are:

1. Set up the hardware - follow steps in "Hardware Setup – Playback" on page 12
2. Set up the RF target (VSG, spectrum analyzer, system under test, etc.)
3. Set up the desired playback method - follow one of the choices below:
   - User Interface - follow steps in "Playback with IQC Control" on page 58.
   - Command Server/API – see the IQC5000 API Programming Manual
4. Playback

IQC5000 Supported Playback Acquisition Bandwidths

Select discrete acquisition bandwidths are supported for playback. If playback of a recording is desired, it is recommended to record at a playback-supported acquisition bandwidth.

Table 16 - IQC5000 Supported Playback Acquisition Bandwidth- Keysight

I/Q Sampling Rate (Sps)	Data Rate (Bytes/s)	Keysight Recording Spans (Hz)	
		X-series with RTS Option	X-series without RTS Option
300,000,000 down to 31,250,000 in any step supported by the signal analyzer	4x IQ Sampling Rate	255,000,000 down to 24,949,188	40,000,000 down to 25,000,000
25,000,000	100,000,000	20,000,000	20,000,000
12,500,000	50,000,000	10,000,000	10,000,000
6,250,000	25,000,000	5,000,000	5,000,000
3,125,000	12,500,000	2,500,000	2,500,000
1,562,500	6,250,000	1,250,000	1,250,000
781,250	3,125,000	625,000	625,000

Table 17 - IQC5000 Supported Playback Acquisition Bandwidth- Rohde & Schwarz

I/Q Sampling Rate (Sps)	Data Rate (Bytes/s)	Rohde & Schwarz Recording Spans (Hz)	
		FSV/ FSVR	FSW
300,000,000 down to 31,250,000 in any step supported by the signal analyzer	4x IQ Sampling Rate	40,000,000 down to 25,000,000	160,000,000 down to 25,000,000
25,000,000	100,000,000	20,000,000	20,000,000
12,500,000	50,000,000	10,000,000	10,000,000
6,250,000	25,000,000	5,000,000	5,000,000
3,125,000	12,500,000	2,500,000	2,500,000
1,562,500	6,250,000	1,250,000	1,250,000
781,250	3,125,000	625,000	625,000

Table 18 - IQC5000 Supported Playback Acquisition Bandwidth- Tektronix

I/Q Sampling Rate (Sps)	Data Rate (Bytes/s)	Tektronix Recording Spans (Hz)		
		RSA6000	RSA5000A	RSA5000B
300,000,000 down to 31,250,000 in any step supported by the signal analyzer	4x IQ Sampling Rate	110,000,000 down to 25,000,000	110,000,000 down to 25,000,000	165,000,000 down to 25,000,000
25,000,000	100,000,000	20,000,000	20,000,000	20,000,000
12,500,000	50,000,000	10,000,000	10,000,000	10,000,000
6,250,000	25,000,000	5,000,000	5,000,000	5,000,000
3,125,000	12,500,000	2,500,000	2,000,000	2,500,000
1,562,500	6,250,000	1,250,000	1,000,000	1,250,000
781,250	3,125,000	625,000	500,000	625,000

Table 19 - IQC5000 Supported Playback Acquisition Bandwidth- Anritsu

I/Q Sampling Rate (Sps)	Data Rate (Bytes/s)	Anritsu Recording Spans (Hz)
200,000,000 down to 31,250,000 in any strip supported but the spectrum analyzer	4x IQ Sampling Rate	110,000,000 down to 25,000,000
25,000,000	100,000,000	20,000,000
23,040,000	92,160,000	18,000,000
15,360,000	61,440,000	12,000,000
12,500,000	50,000,000	10,000,000
7,680,000	30,720,000	6,000,000
6,250,000	25,000,000	5,000,000
3,840,000	15,360,000	3,000,000
3,125,000	12,500,000	2,500,000
1,920,000	7,680,000	1,500,000
1,562,500	6,250,000	1,250,000

Markers

The IQC5000 supports time- and location-stamping recordings, using markers to correlate the time and location (location is only available if GPS is connected and valid) to a specific sample in the recording. A time (and location, if GPS is connected and valid) will automatically be assigned to the beginning and end of the recording.

To mark data, attach a TTL-level trigger source to the Marker 1 or Marker 2 inputs on the rear of the IQC5000; alternatively, press the MARK button on the front panel of the IQC5000. A marker will be placed in the recording's .xmrk file that will correspond to the time/location and sample point on the trigger rising edge, falling edge, or both – this is configurable in IQC Control (see "Setting up Markers" on page 56) and the API. The re-arm time for markers is 1ms; the marker rate is effectively 1,000 markers per second. See The "The xmrk Marker File" on page 67 for information about the marker file format.

Timing

The IQC5000 follows a hierarchy when choosing which time source to use:

Table 20 - IQC5000 Timing Hierarchy

Priority	Time Source	Description
1	IRIG-B	Most precise method of time-stamping
2	NMEA-GPS	If IRIG-B signal is not present, use NMEA time if attached and valid
3	Workstation Time	Used for IQC Control software UI or API recordings only, if IRIG-B or NMEA GPS signals are not present

Note: *An external time source must be used when using Time of Day record triggers.*

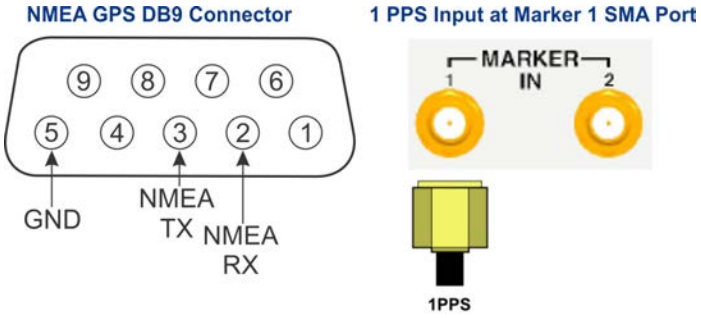
NMEA Data

The IQC5000 supports the following NMEA-formatted data input:

Table 21 - IQC5000 NMEA Data Input

Connectors	DB-9 (with optional 1 pulse per second signal connected to Marker 1 SMA input) See Figure 22.
NMEA Sentences	GPGGA GPVTG GPZDA
Protocol Standard	RS-232

Figure 22 NMEA Data Input



NMEA custom cables are available from Bird. The 1PPS signal may be optionally connected to the Marker 1 SMA port to insert a marker every second.

The baud rate for the NMEA GRPS input (DB9) is selectable. See"NMEA GPS Port Baud Rate Selection" on page 48.

File Transfer

There are 2 supported methods of transferring data between the IQC5000 storage and the Computer Workstation storage:

- PCIe – The fastest way to offload data. Requires the use of a PCIe cable. Offload speeds up to 450MB/s are possible if offload destination supports writing at that speed. Connect the PCIe cable between the IQC-MEM module and the Computer Workstation. See "Setup" on page 8 for more information.
- Ethernet – The slowest way to offload data. Requires no additional cables.

Chapter 4 Using IQC5000 with IQC Control

The IQC5000 is controlled through IQC Control. An API is available for controlling the IQC5000, and is detailed in the IQC5000 API Programming Manual. The following sections detail IQC Control's Graphical User Interface.

Installing the IQC Control Software and Loading the IQC5000 Firmware

On the IQC5000 software CD shipped with the product, access the file IQC5000_setup_vW.X.Y.ZZZ.exe, where W.X.Y.ZZZ represents the version number of the installer. This software and firmware installer installs the IQC Control software, and also updates the firmware on an IQC5000 over Ethernet. The IQC5000 firmware can only be updated if it is powered on and networked to the PC running the installer. Note that if the firmware on more than one IQC5000 system is being updated at any given time, it is important to ensure that each IQC5000 has a different IP address.

The following software is required to run IQC Control:

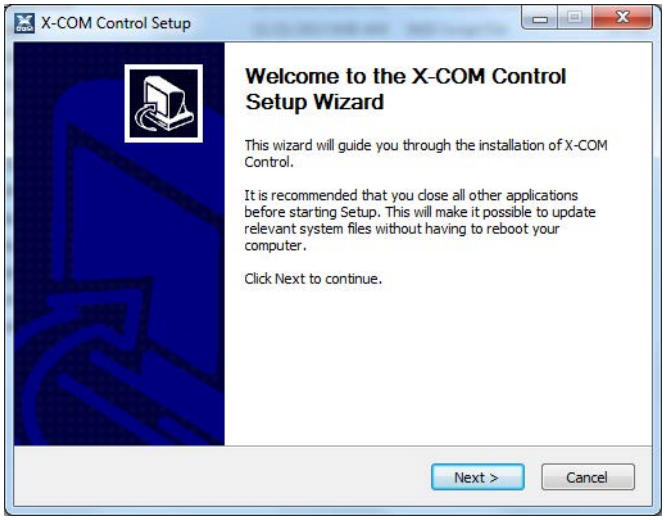
- Microsoft® Windows 7™ 64-bit or Windows 8™ 64-bit
- Microsoft® Visual C++ 2013 x64 Redistributable Package (included in IQC Control installation)
- Microsoft® .NET Framework 4.5.2 or later

Install the IQC Control software and load IQC5000 firmware

1. Determine the IP address of your IQC5000:
    a. Verify that the IQC5000 is powered on and connected to the network. It is highly recommended to use a hard-wired Ethernet connection on a network with minimal network traffic while updating.
    b. Press the MENU button on the front panel of the IQC5000.
    c. Navigate to NIC Parameters through the menu items using the left and right arrow keys.
    d. Press the down arrow key until IP Address is selected.
    e. The IQC5000 IP Address is shown – make note, as it will be used in later steps.
2. Completely power off the IQC5000 system. If IQC-MEM is being used, follow the proper power-off sequence, as described in "Starting and Stopping the System" on page 26.
3. If IQC-MEM is being used and cabled to the IQC5000, leave the external storage units powered off, then power on the IQC-MEM unit and allow it to boot for 30 seconds.
4. Power on the IQC5000. Once the front panel displays SYSTEM READY, continue with Step 5.

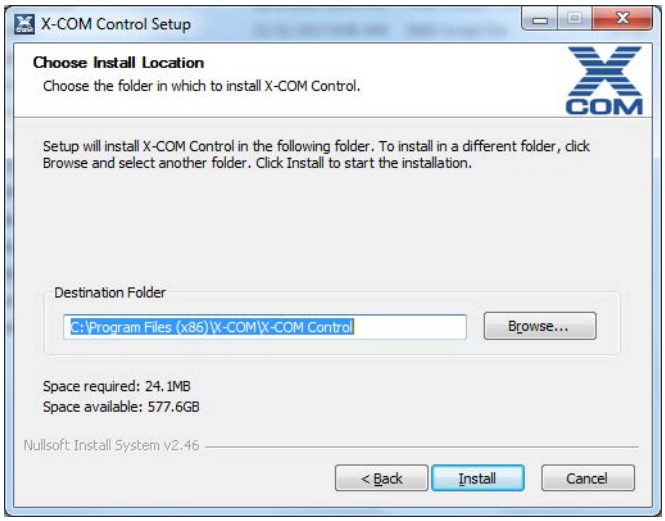
    Note: *Wait until front panel displays SYSTEM READY, before continuing to Step 5.*
5. Run the installer IQC5000_setup_vW.X.Y.ZZZ.exe.
6. Click Next. See Figure 23 on page 38.

Figure 23 IQC Control Setup Wizard



7. Choose the installation directory and then click Install.

Figure 24 IQC Control Directory Selection



8. The firmware update message box will display:
   a. Enter the IP address of your IQC5000 in the IP Address text box and click the Connect button.

      Alternatively, if the device has previously been added as a tab in IQC Control select the device from the list at the bottom of the window.

      If there is an issue connecting, a message box will display. See “Connecting to the IQC5000” on page 45 for details on troubleshooting connection issues.

      Note: *Some configuration options, such as selecting Single or Dual RAIDS, must be selected during a firmware update. For more information on advanced features. See “Firmware Configuration Updates” on page 82.*

   b. System defaults to Single RAID configuration. If Dual RAID operation is desired, perform the following:

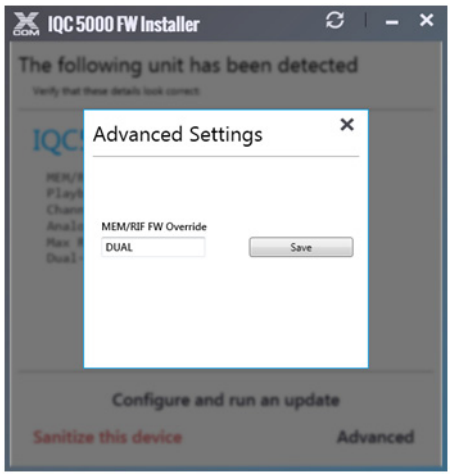
i. Once the IQC5000 unit has been detected, select Advanced in the lower right corner of the IQC 5000 FW Installer dialog box. See Figure 26.

ii. In the MEM/RIF FW Override field, enter one of the following codes. See Figure 25.

- SINGLE - enter this code to switch from Dual RAID mode to Single RAID mode.
- DUAL - enter this code to switch from Single RAID mode to Dual RAID mode.

Note: *The codes must be entered in all caps, with no spaces or extra characters.*

Figure 25 Advanced Settings Selection Dialog



ii. Click Save.

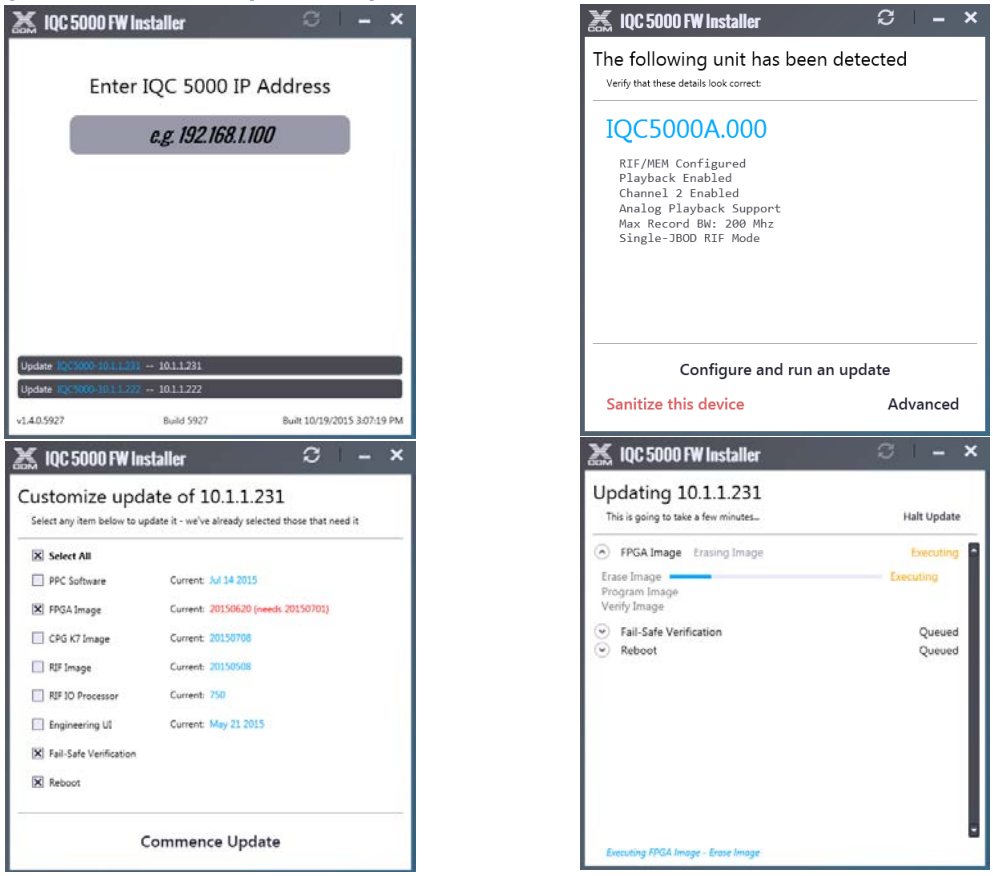
c. Verify the IQC5000 details are correct and click Configure and run an update.

CAUTION
Disconnecting power from the IQC5000 during the firmware upgrade process could result in permanently disabling some features of the IQC5000 system.

d. Firmware that has been detected as requiring an update will be pre-selected. Click Commence Update. The progress of the firmware installation is displayed.

Note: *It is not recommended to manually overwrite firmware unless instructed to do so by Bird support.*

Figure 26 IQC5000 Firmware Update Sequence



e. After the firmware installation process has finished, click OK to close the firmware installation.

f. Power off the IQC5000:

   i. If IQC-MEM is being used, the IQC-MEM module should be powered off first.

   ii. Power off the IQC5000.

g. If IQC-MEM is being used with external storage units:

   i. Power on the external storage units and allow it to boot for 30 seconds.

   ii. Power on the IQC-MEM module and allow it to boot for 30 seconds.

h. Power on the IQC5000.

9. Click Finish to close the installer.
10. Restart the Computer Workstation.

The IQC Control software has been installed and the IQC5000 firmware has been updated. The IQC5000 is now ready to use.

Installing the PCIe Driver

With all of the equipment powered down, ensure the Ethernet and PCIe connections are made as described in Chapter 2 "Setup" on page 8.

To install or update the PCIe driver:

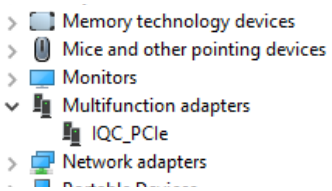
1. Power on the control computer or real time spectrum analyzer where IQC Control is or will be installed, but leave the IQC and MEM(s) powered off.

   Note: *IQC and MEM(s) units should remain powered off until IQC_PCIe installer is completed.*

2. Install the driver with the IQC_PCIe_setup.exe installer.
   This will first uninstall the old PLDA PCIe driver and any previous version of the existing driver on the machine and then install the new PCIe driver.

3. After the installer is complete, IQC_PCIe should be shown in the Windows Device Manager, device tree, see Figure 27.

Figure 27 Windows Device Manager — Multifunction Adapters

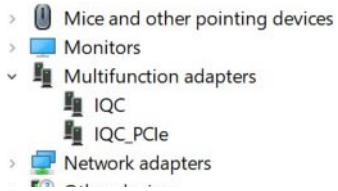


4. Apply power to the complete IQC System and other attached equipment in the recommended order. See step 7. “Power on the Units:” on page 14.
5. When the IQC System powers up, Windows will most likely popup the "Installing device driver software" bubble (see Figure 28). When this opens, Windows is searching "Windows Update" for the most recent driver for the IQC PCIe link. If you click on the bubble, Windows will open the Driver Software Installation dialog.

Figure 28 Windows Driver Installation

6. When Driver Software Installation is complete, a second IQC device can be found in the Windows Device Manger Tree under Multifunction adapters to verify successful installation and device detection. See Figure 29.

Figure 29 Windows Device Manager — Multifunction Adapters



Starting IQC Control

Shortcuts on the desktop and Start menu are created when IQC Control is installed.

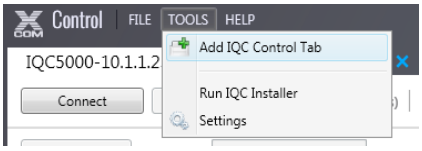
To access the Start menu shortcut, navigate to Start > All Programs > X-COM > X-COM Control > X-COM Control.

Adding an IQC5000 to IQC Control

The IQC5000 is added as a device in IQC Control and can be accessed as a tab on the main user interface or in a separate window.

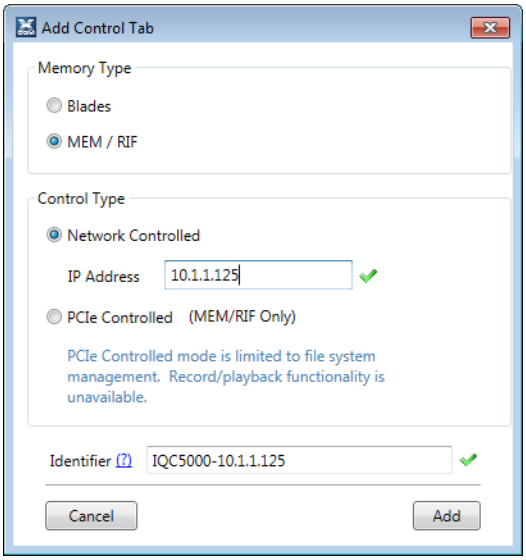
1. Start IQC Control.
2. Select Tools > Add Control Tab. The Add Control Tab menu appears.

Figure 30 Adding an IQC5000 to IQC Control



3. Select the device type from the supported device list. For IQC-MEM, select MEM/RIF.

Figure 31 Add Control Tab Dialog Box



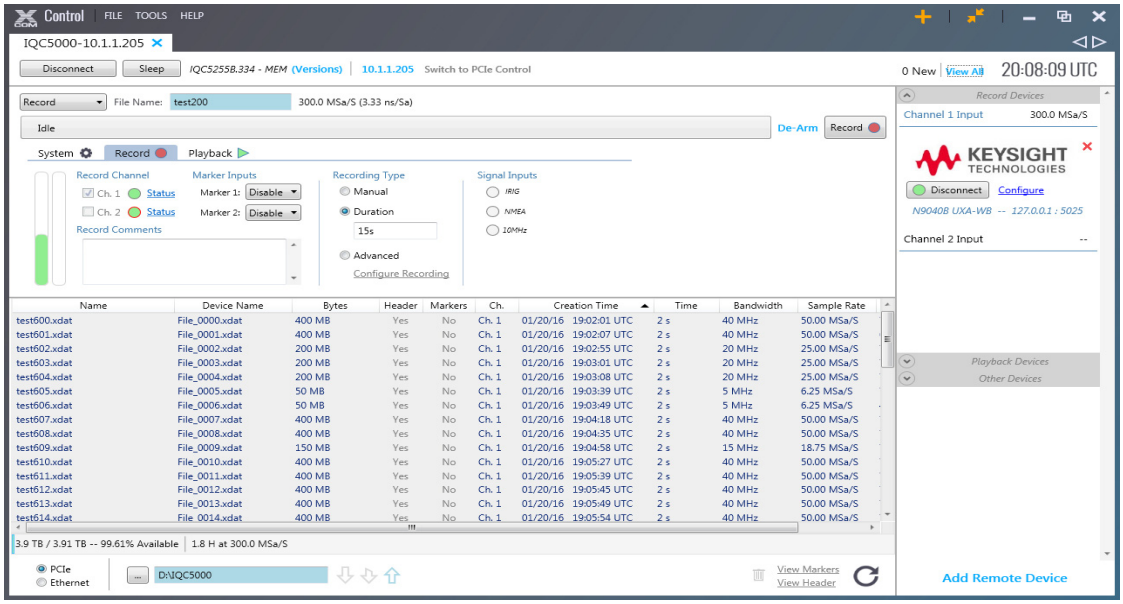
4. Select Network Controlled and enter the IP address of the device. A red X ✗ or green check mark ✓ shows whether the IP address is of acceptable format. (For information on PCI Controlled mode, see "File Transfer Methods" on page 61.)
5. (Optional) Enter a descriptive identifier for the device by de-selecting the Generate Identifier check box and entering your own text. If the check box is left checked, an identifier string will be created from the device type and IP address.
6. Press Add.

The IQC5000 Control Tab Layout and Visual Components

The IQC5000 control tab can be broken down into 3 main sections (See “IQC5000 Control Tab” on page 43):

- IQC5000 Management – at the top left of the tab, this pane manages recording, playback, marker, and trigger parameters.
- File Management – at the bottom of the tab, this pane shows all recorded files.
- Remote Device Management – at the right of the tab, this pane manages peripheral devices (including the spectrum analyzer and other auxiliary devices).

Figure 32 IQC5000 Control Tab



System, Record, Playback Tabs

The System, Record, and Playback Tabs are used to configure system operation.

Figure 33 System, Record, and Playback Tabs

- System tab is used to select and configure RAIDs, set maximum record file size, set NMEA GPS baud rate, and monitor system temperatures. See “Managing IQC5000B-MEM External Storage” on page 46.
- Record tab is used to select input channels, enable marker inputs, select recording type and view presence of external input signals. See “Recording with IQC Control” on page 53.
- Playback tab is used to select playback channels, output type, and start and stop times. See “Playback with IQC Control” on page 58.

Progress Bar

The progress bar is located near the top of the IQC5000 Management section. It displays the state of the IQC5000 – such as Idle when it is not performing any action – and the progress of the current operation (such as record, playback, or erase). In certain situations, such as for recordings waiting for a stop trigger, the progress bar will show that it is recording with no respect to time. Manual recordings show the progress in respect to how much memory is left.

Indicators

The IQC5000 system takes on the role of a hub for many signals and operations, and for this reason, indicators are used heavily within the user interface. Simple circles that light green or red indicate the presence or the readiness of a specific component. The Recording Channel indicators are unique and are covered in "Channel Selection" on page 54.

VU Meter

The VU Meter is located at the left side of the IQC5000 Management section. There are 2 bars – the left corresponds to the Channel 1 recording, and the right to the Channel 2 recording.

The VU Meter graphically represents the maximum digitized value in relation to the dynamic range of the digitizer. After the refresh time of 300ms, the VU Meter is updated to reflect the maximum value detected during that 300ms. This is a maximum value hold operation, rather than averaging the value.

It is important not to under-range or over-range (clip), but effectively utilize the maximum dynamic range of the digitizer. For example, the importance is the same as recording a human voice with a microphone at a gain level suited for a whisper, or for shouting, depending on the expected performance's volume level.

Table 22 - VU Meter Color Gradient

	Percentage of Digitizer Max Value	
Color	**Linear**	**Logarithmic**
Red	85.1 - 100%	97.6 - 100%
Orange	75.1 - 85%	93.6 - 97.5%
Yellow	65.1 - 75%	90.1 - 93.5%
Green	0 - 65%	0 - 90%

There are two modes – linear and logarithmic – selectable by right-clicking the VU Meter. Linear mode displays the ratio of the digitized value to the dynamic range of the digitizer in bits, linearly. Logarithmic mode displays the maximum value in terms of power, logarithmically.

Ideally, the recording should be made as close to the maximum level as possible, considering the possible change in signal amplitude that may result in over-ranging. Therefore, it is recommended that the recording be made as close to the linear 85% level, where the VU Meter changes from orange to red. If a known signal of constant amplitude is being recorded, this level can be pushed further to the 90 - 95% level.

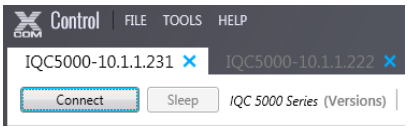
The maximum value detected during a recording is saved to the recording's header file.

Connecting to the IQC5000

Establishing Connection

Press the Connect button to connect to the IQC5000.

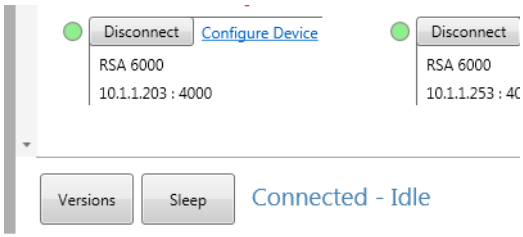
Figure 34 IQC5000 Connection



Establishing the connection triggers a quick and simple automated process that runs through a series of verification procedures in order to ensure optimal device connectivity and operation. Connections to any previously used remote devices are also established as part of this routine.

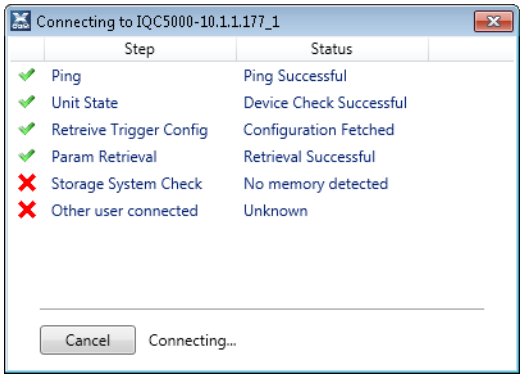
Once the device is connected, the Connect toggle button will change to Disconnect, and the connection status at the bottom-left of the tab shows the IQC5000 is connected and in IDLE mode.

Figure 35 Connection Status



If a connection is made immediately (without failure), the user interface will become active.

Figure 36 Connection Monitor Dialog



In the event of a failure, or if a subsystem is still booting, a connection monitoring window will be shown that allows either the monitoring or the canceling of the connection routine. Once the connection attempt is successful, the window will close and the main interface will become enabled.

The connection steps are:

1. Ping/Port Fetch – Ensure network presence and retrieve the device's port number
2. Unit State – Ensure that the device's control processor has booted properly
3. Retrieve Trigger Config – Trigger Parameters are retrieved to populate UI fields
4. Param Retrieval – Start/Stop Methods are retrieved to populate UI fields

5. Storage System Check – The storage device is checked and the list of files currently stored on the storage device are retrieved to populate UI fields
6. Other User Connected – Checks to see if another client is controlling the same IQC5000

If the connection halts on the Other User Connected step, the other user may be forcibly disconnected by right-clicking the step and selecting Override IP Verification.

For more help diagnosing connections problems, see "Connection Problems" on page 69 in the Troubleshooting section.

Disconnecting

Press the Disconnect button to disconnect from the IQC5000.

At any time during normal operation, the device may be disconnected in order to shut down IQC Control, or to allow operation from another workstation.

Managing IQC5000B-MEM External Storage

If an IQC-MEM module is being used to record data to external storage units, the RAID Selection settings will be configurable.

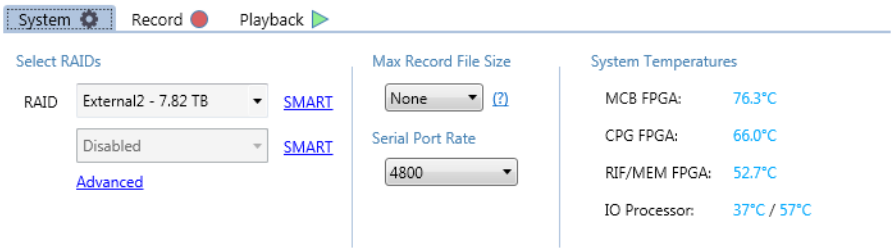
If a valid RAID isn't detected, the borders of the UI will flash red and the progress bar will display NO RAID, indicating that a RAID needs to be selected before recording can begin.

Specific procedures for creating Single and Dual RAIDS are located in "Advanced RAID Configuration Modes" on page 82.

Configuring RAIDs

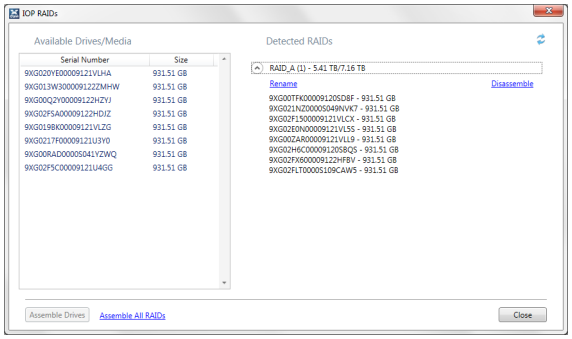
To configure a RAID, click on the System Tab (System).

Figure 37 System Tab



Click on Advanced in the RAID section of the System Tab to bring up the RAID Assembly/Disassembly menu.

Figure 38 RAID Assembly



Unused disks not currently assembled in a RAID are listed on the left under Available Drives/Media. Assembled/ Mounted RAIDs and their disks are listed on the right under Detected RAIDs. Serial number and size are shown for each disk.

Unused disks are available for assembly. To assemble them as a RAID, click Assemble all RAIDs in the lower-left corner of the menu. This instructs the IQC-MEM module to automatically build the optimal RAID configuration based on the disks available. An alternate approach – only recommended for advanced users – is to select a series of unused disks and click Assemble Drives. Assembled RAIDs are available and ready for use.

After a RAID has been assembled, it will be listed under Detected RAIDs. Click on a RAID to expand the list of its member disks.

To disassemble a RAID, click on the RAID and then select Disassemble. The disassembled RAID member disks will be transferred to the Available Drives/Media list.

If an external storage unit is attached while the IQC5000 and IQC-MEM are powered on, click the Refresh button in the upper-right corner to refresh the disk list.

Specific procedures for creating Single and Dual RAIDS are located in "Advanced RAID Configuration Modes" on page 82.

Selecting a RAID for Use

To select a RAID, click on the System tab (System) to display the RAID controls. Once a RAID has been configured for use, it will become available in the RAID dropdown menu(s). For single external storage unit setup, select the configured RAID device from the RAID drop-down menu to select it as the recording device. For dual external storage unit setup, select the desired RAID devices for each I RAID and Q RAID.

RAID Self-Monitoring, Analysis and Reporting Technology (SMART) Data

SMART Data are a collection of metrics that help to communicate the health of an HDD/SSD. SMART Data are managed by the HDD/SSD controller and stored on the local disk, and include metrics such as temperature, read errors, write errors, and much more. Click on the SMART link next to a configured RAID to view the SMART data for the disks that make up that RAID. See Figure 37 on page 46.

Maximum Record File Size

If a maximum recorded file size is desired, use the Max Record File Size option on the System Tab. Setting the Max Record File Size to something other than the default setting of None will cause recordings to be split into multiple recordings once the max record file size has been met. Subsequent recordings will be followed by a number signifying the order in which it was recorded.

For example, if a Max Record File Size of 1TB is selected and then 3TB of data is recorded, the first 1TB of recorded data will be stored as <*Filename*>, followed by the next 1TB stored as <*Filename2*>, and the last 1TB as <*Filename3*>.

NMEA GPS Port Baud Rate Selection

The baud rate for the NMEA GPS input to the IQC5000 is selectable on the System Tab (Figure 37 on page 46). The baud rate for the NMEA GPS serial port may be set to 4800, 9600, or 115200.

System Temperatures

The current temperatures of important internal components may be viewed on the System Tab under System Temperatures (Figure 37 on page 46). The text color will change from blue to red when a critically high temperature has been met.

Sleeping/Waking the IQC5000B-MEM

The IQC5000B-MEM must be set to sleep before disconnecting the external storage hardware or removing an internal SSD RAID module. This is done by pressing the Sleep button at the top of the window. The Sleep button will then change to Wake. To use external storage unit or internal SSD RAID module again after being put to sleep, press the Wake button.

Changing the IQC5000 IP Address

Click the IP Address link next to the IP address to open the Change IP Address menu.

From here, it is possible to change the local reference to the IP address (in the case that you typed the wrong IP address when creating a tab), or change the IP address of the IQC5000. Enter the new IP address and select to either change the local reference or the device IP address, then click Change.

Changing the IQC5000 Subnet Mask

Click the IP Address link next to the IP address to open the Change IP Address menu.

From here, it is possible to change the subnet mask of the IQC5000.

Remote Devices

The IQC Control UI offers users a quick way to manage supported peripheral devices.

Table 23 - Supported Devices for Remote Control

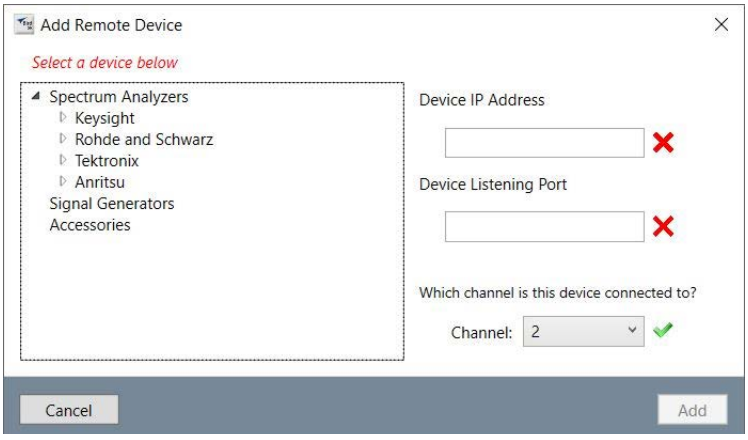
Device Type	Vendor	Supported Devices	Device Listening Port
Spectrum Analyzer	Keysight	UXA	5025
		PXA	
		MXA	
		EXA	
	Rohde & Schwarz	FSV/FSVR	5025
		FSW	
		DigIConf (Configurable as a subsystem of the FSV/FSW)	5026
	Tektronix	RSA 6000 Series	4000
		RSA 5000 Series	
	Anritsu	Field Master Pro MS2090A	9001
Accessory	Dowkey	RF Switch	10

Adding a Remote Device

To add a device:

1. Click Add Device at the bottom of the Remote Devices panel. A connection wizard appears.

Figure 39 Add Remote Device



2. Select the device from the list tree of supported devices in the left pane. The default Device Listening Port for the chosen device is pre-filled.
3. Enter the IP Address.
4. If adding a spectrum analyzer, select the Channel the device is connected to.

   If adding an accessory, such as the DowKey RF Switch, no channel will be assigned (see "DowKey RF Switch" on page 51 for details).

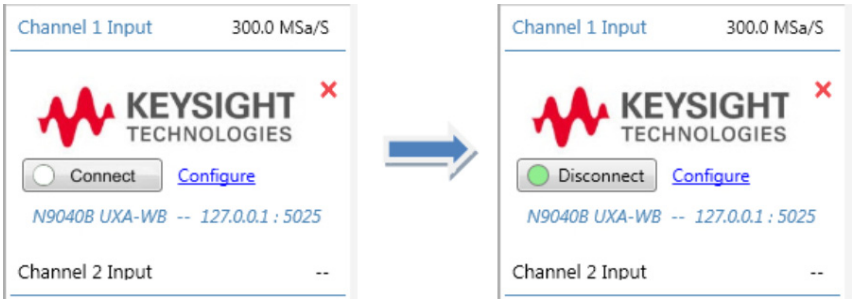
5. Click Add.

A widget will appear in the Remote Devices section representing the newly added remote device.

Connecting/Disconnecting to a Remote Device

Press Connect within the device's widget to connect to the device. When a device is connected, the indicator next to the Connect/Disconnect toggle button will be green.

Figure 40 Connecting to Remote Device



Press Disconnect to disconnect from the device.

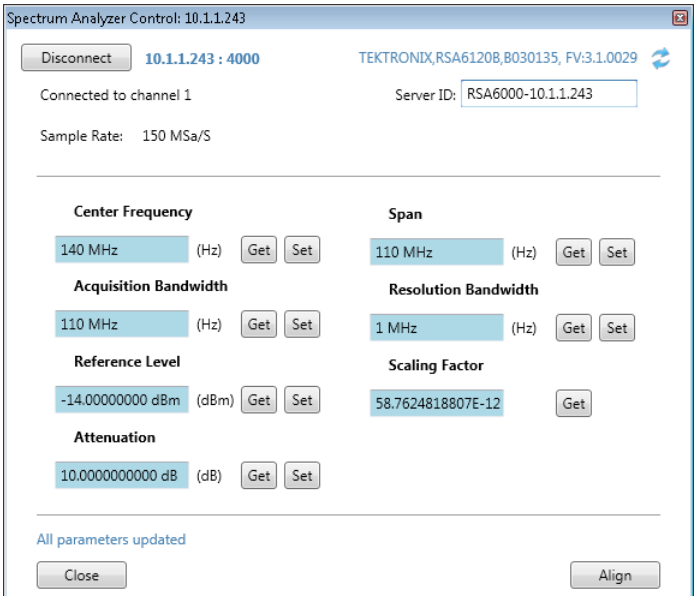
Note: *For Rohde and Schwarz spectrum analyzers: DigIConf must be configured before a successful connection is made. The default configuration uses the FSW IP address – for any other custom setup, select Configure Device > DigIConf and enter the IP address/port number of the workstation running DigIConf (use the loopback address of 127.0.0.1 and port 5026 when running DigIConf locally).*

Managing Remote Devices

Spectrum Analyzers

After adding and connecting to the spectrum analyzer, press Configure Device on the device's widget to access the device's remote control panel.

Figure 41 Configure Remote Spectrum Analyzer



For spectrum analyzers, the device control panel displays the Device IDN (typically the manufacturer, model number, and firmware version) in the upper-right corner of the control panel window. Below it is the Server ID: this string is the identifier for this device to the IQC Control API command server. Changing the Server ID modifies the prefix used when addressing devices using the API. See the IQC5000 API Programming Manual for more details.

The IP address/port number and channel of the spectrum analyzer, as well as the detected sample rate are shown in the upper-left corner.

Vital configurable parameters are available to Get and Set. By pressing Get, the parameters will be updated in the control panel. By pressing Set, the value entered in the text box will be sent to the remotely controlled device. Press the Refresh button ( ) in the upper-right corner to update all of the parameters at once.

Align (calibrate) the device by pressing Align in the bottom-right corner of the window. Recording will be temporarily unavailable while alignment is in process.

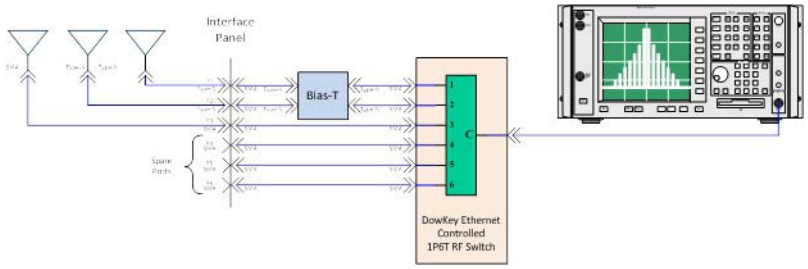
Each channel used for recording must have a separate remote device added. When using dual channel record, spectrum Analyzers can be switched between channels by clicking and dragging from one channel to the other.

> **Note:** *For Rohde and Schwarz spectrum analyzers: the DigIConf control menu is available by clicking on the DigIConf button in the lower-left corner of the menu.*

DowKey RF Switch

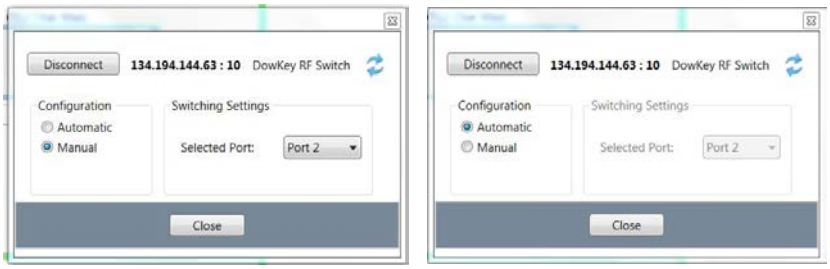
The DowKey RF switch allows users to automatically or manually select one of six RF inputs to the spectrum analyzer. The inputs are normally connected to different types of external antennas, optimized for frequency coverage in the bands of interest.

Figure 42 DowKey RF Switch Diagram



After adding the DowKey RF switch as a remote device and connecting to it, press Configure Device on the device's widget to access the device's remote control panel. From here, select either Automatic or Manual operation.

Figure 43 DowKey RF Switch Mode Selection



In Manual mode, the user is permitted to over-ride the automated frequency-dependent port assignments by manually configuring the Selected Port (switch port assignment).

In Automatic mode, the antenna port is automatically selected for the specified center frequency of the spectrum analyzer, according to the frequency limit settings in the DOWConfig.txt configuration file, located in the IQC Control program directory.

DOWConfig.txt Syntax and Usage:

P1 : <low frequency limit in Hz> - <high frequency limit in Hz>

P2 : <low frequency limit in Hz> - <high frequency limit in Hz>

P3 : <low frequency limit in Hz> - <high frequency limit in Hz>

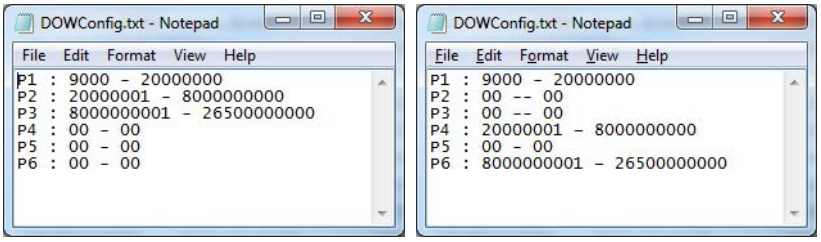
P4 : <low frequency limit in Hz> - <high frequency limit in Hz>

P5 : <low frequency limit in Hz> - <high frequency limit in Hz>

P6 : <low frequency limit in Hz> - <high frequency limit in Hz>

- Pn references the RF port to which the antenna is connected
- Frequencies are expressed in Hertz
- Frequencies must not overlap between ports
- All ports must be listed in order
- Unused ports must be entered as 00 – 00
- The file must be named DOWConfig.txt
- The file must be in the following directory: %APPDATA%\XCOM\XCOMControl\config (default: C:\Users\USERNAME\AppData\Roaming\XCOM\XCOMControl\config)

Figure 44 Sample DOWConfig.txt Files



Recording with IQC Control

> **Note:** *Select discrete acquisition bandwidths are supported for playback. If playback of a recording is desired, it is recommended to record at a playback-supported acquisition bandwidth. See "IQC5000 Supported Playback Acquisition Bandwidths" on page 33.*

To set up for recording using IQC Control:

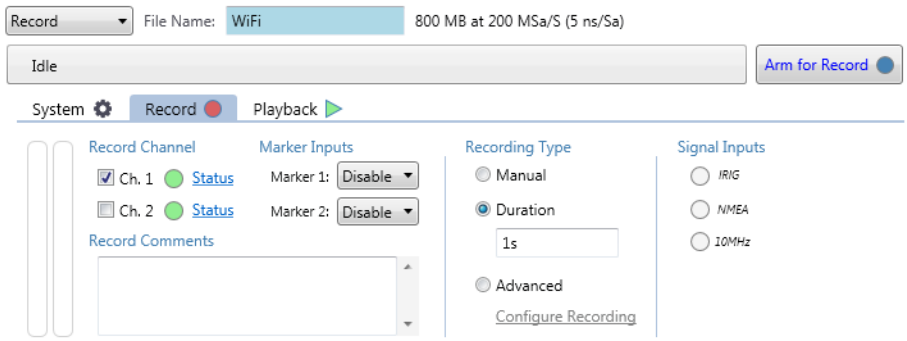
1. Ensure correct setup:
   a. Hardware - See step “Hardware Setup – Record” on page 8.
   b. Network - See step “Network Setup” on page 15.
   c. Spectrum analyzer - see setup for your spectrum analyzer type.
2. Add an IQC5000 tab in IQC Control - follow steps in "Adding an IQC5000 to IQC Control" on page 42.
3. Connect to the IQC5000 - follow steps in "Establishing Connection" on page 45.
4. Manage IQC5000B-MEM external storage - follow steps in "Managing IQC5000B-MEM External Storage" on page 46.
5. Add the spectrum analyzer as a remote device - follow steps in "Adding a Remote Device" on page 49.
6. Connect to the spectrum analyzer - follow steps in "Connecting/Disconnecting to a Remote Device" on page 50.
7. Set the IQC5000 into record mode - follow steps in "Setting the IQC5000 into Record Mode" on page 54.
8. Select the record channel(s) - follow steps in "Channel Selection" on page 54.
9. Identify signal of interest on spectrum analyzer
10. Determine and set recording start/stop methods - follow steps in "Record Modes" on page 54.
11. (Optional) Configure marker settings - follow steps in "Setting up Markers" on page 56.
12. Name and describe the recording - follow steps in "Naming and Describing the Recording" on page 56.
13. Modify center frequency, input power settings, and acquisition bandwidth as desired on the spectrum analyzer, or through IQC Control
    Once the initial configuration is set, IQC Control recording is readied by arming the IQC5000.
14. Press the Arm for Record button - see "Arming" on page 57
    The IQC5000 is now ready to record. The start method will dictate when the recording is initiated for triggered or time of day recordings. Manual recordings can be started/stopped at any time.
15. Press the Record button. Wait for the desired duration of the recording.
16. Press the Stop button.

The following sections outline the necessary steps to set up the IQC Control software to record with the IQC5000.

Setting the IQC5000 into Record Mode

Press the drop-down Mode button and select Record to set the IQC into record mode.

Figure 45 IQC Control Recording Setup



Channel Selection

The IQC5000 is capable of recording 2 streams of LVDS data from similar spectrum analyzers outputting data at the same sample rate. Select to use Channel 1, Channel 2, or both for recording.

The Channel Status Indicators will show the IQC5000 channel is receiving a valid data signal when the circle inside area is green. When the IQC5000 is connected to a spectrum analyzer, the line around the circle will be grey; if a spectrum analyzer is not connected correctly, the line will be red.

Clicking on the Status link to the right of the channel checkbox will run a diagnostic for that channel and display action required to record using that channel.

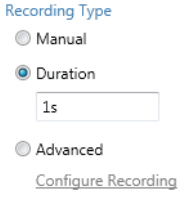
Signal Inputs

External input signals can be monitored with these indicators. When green, a signal is detected; when grey, no signal is detected.

Record Modes

The Recording Configuration pane is where the start/stop methods of the recording are set and displayed.

Figure 46 Record Mode Selection



Basic Modes

1. Manual Record

   The IQC5000 default record mode is Manual Record. Select the option Manual in the Recording Configuration pane. Then click the Record/Stop button after the spectrum analyzer has been armed to manually start the recording, and once again to stop the recording.

2. Duration Record

   There are 2 types of Duration Record: Timed and Sample Length. Basic timed recordings are manually started and set to complete after the specified amount of time has elapsed. Basic sample length recordings are manually started and set to complete after the specified amount of samples has been recorded.

   Select the option Duration in the Recording Configuration pane. To specify time, use units ns, us, ms, M, or H (nanoseconds, microseconds, milliseconds, seconds, minutes or hours). To specify a sample length, enter the amount of samples without units to record.

Advanced Modes

To access the advanced recording settings, select Advanced and then Configure Recording in the Recording Configuration pane. There are 4 advanced recording tabs.

The Start tab lists the available methods to start a recording, and the Stop tab lists the available methods to stop a recording. There is one additional method on the Stop tab that is not available on the Start tab: Duration. (This is because a recording cannot logically be started on a duration, but instead commences and ends after a specified duration.)

The Start Trigger tab contains the trigger settings that are used if Trigger is selected as the Start option. The Stop Trigger tab contains the trigger settings that are used if Trigger is selected as the Stop option. There are no differences between the options available for start trigger and stop trigger.

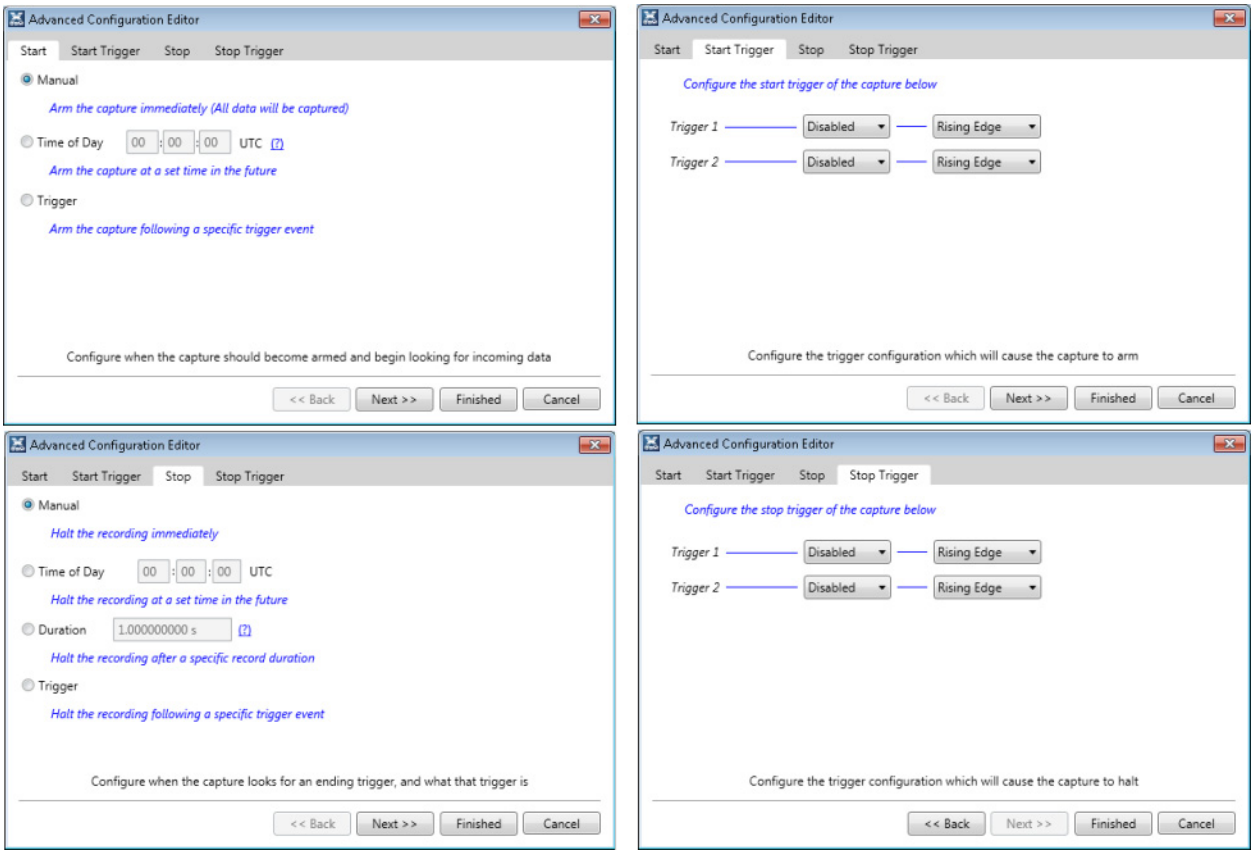
Table 24 - Advanced Start and Stop Recording Methods

Tab	Options	Description
Start & Stop	Manual	Sets the recording to start when the user presses Record, or stop when the user presses the Stop button.
	Time of Day	Sets the recording to start or stop at a time of the day (such as 12:00:00).
	Trigger	Sets the recording to start on trigger- see Table 25.
Stop Only	Duration	Records for Timed duration or Sample Length duration. To specify time, use units ns, us, ms, M, or H (nanoseconds, microseconds, milliseconds, seconds, minutes or hours). To specify a sample length, enter the amount of samples without units.

Table 25 - Advanced Trigger Recording Parameters

Trigger Enable	Description
Disabled	Trigger is not used
Enabled	Only the one selected trigger is used
Trigger Edge	
Rising Edge	Trigger arm looks for rising edge
Falling Edge	Trigger arm looks for falling edge

Figure 47 Advanced Recording Configuration Dialog Boxes



Setting up Markers

Markers can be manually generated by pressing the Mark button on the front panel of the IQC5000.

For precision markers, TTL-level marker source(s) can be attached to Marker 1 and/or Marker 2 on the rear of the IQC5000. A marker will be inserted into the .xmrk marker file of the recording when there is a rising, falling, or both rising and falling edge signal. Set the edge detection under Marker Input.

Naming and Describing the Recording

To the right of the Record/Playback drop down is the File Name text box.

If you wish to provide a description about the recording, enter up to 512 characters into the Recording Comments box. Information such as RF modulation type, spectral behavior, or recording location (if a GPS signal is not connected) may be worth entering for future notice.

The option Auto-Increment File Name will append a number to the end of the File Name when a recording has been completed, and increment it, readying the next file name for the next recording. This makes multiple recordings within a short period of time a smoother process.

Starting/Stopping Record

To start a recording, the spectrum analyzer must first be armed by clicking Arm.

Arming

The spectrum analyzer must first be armed before starting a recording by clicking the Arm/Record/Stop toggle button, located at the right of the IQC5000 management pane. This button will change from Arm to Record when the unit has successfully armed, from Record to Stop after the recording has been initiated, and from Stop to Arm after the recording has stopped.

The Arming process automates configuring often complex settings on the spectrum analyzer for recording. This automation must otherwise be carried out manually when not using IQC Control for recording; i.e., using the front panel to record.

Note: *The spectrum analyzer cannot be armed until a file name is specified.*

Arming takes a different amount of time depending on the model of spectrum analyzer:

Table 26 - Relative Arming Times for Spectrum Analyzers

Vendor	Spectrum Analyzer	Relative Arming Time	Relative De-Arming Time
Keysight	UXA	3 seconds	3 seconds
	PXA		
	MXA		
	EXA		
Rohde and Schwarz	FSV/FSVR	14 seconds	Immediate
	FSW		
Tektronix	RSA 6000 Series	Immediate	Immediate
	RSA 5000 Series		
Anritsu	MS2090A	1 second	Immediate

Starting a Recording Manually

After arming, the recording can be manually started by pressing the Record button.

Stopping

For any recording, pressing the Stop button will end the recording, even if a stop event is specified.

Playback with IQC Control

The IQC5000B is capable of I/Q baseband and RF playback. The I/Q Baseband playback is intended for normal use, RF playback capability should be used for testing and system validation only. Do not use RF Playback for normal use.

To set up for playback using IQC Control:

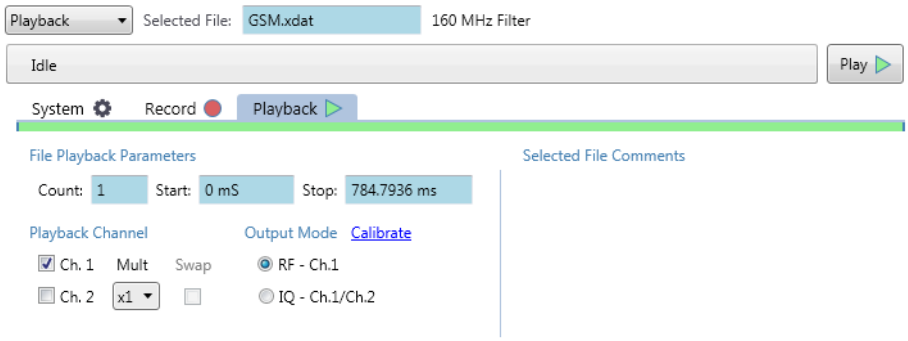
1. Ensure hardware setup - follow steps in "Hardware Setup – Playback" on page 12.
2. (IQC5000B-MEM) Manage IQC5000B-MEM external storage - follow steps in "Managing IQC5000B-MEM External Storage" on page 46.
3. Set up the RF target (spectrum analyzer, system under test, etc.).
4. Select the file for playback - follow steps in "Selecting a File for Playback" on page 58.
5. (Optional) Select playback channel - follow steps in "Selecting a Playback Channel" on page 59.
6. Select RF or IQ output - follow steps in "Selecting RF or IQ Playback" on page 59.
7. (Optional) Select the playback loop count - follow steps in "Setting Playback Loop Count" on page 59.
8. (Optional) Set the start/stop positions - follow steps in "Setting Playback Start/Stop Positions" on page 59.
9. (Optional) Set the playback multiplier - follow steps in "Setting the Playback Multiplier" on page 59.
10. Press the Play button to begin playback.
11. (Optional) Press the Stop button to end playback. If playback is not stopped manually, it will continue to play until the end of the file, as determined by the loop and start/stop positions.

The following sections outline the necessary steps to set up the IQC Control software for playback with the IQC5000.

Setting the IQC5000 into Playback Mode

Press the drop-down Record/Playback button and select Playback to set the IQC into playback mode.

Figure 48 IQC Control Playback Setup



Selecting a File for Playback

Select a file for playback by clicking on it in the File System pane (see "File Management" on page 61). If the IQC5000 is in record mode, double-click the file to select it and set the IQC5000 into playback mode simultaneously.

Alternatively, enter the file name for playback into the Selected File text box.

Selecting a Playback Channel

Single channel recordings can be played back through CH1 or CH2 on the rear of the IQC5000. Select a different Playback Channel if desired. Dual channel recordings are played back as they were recorded (recorded channel 1 is locked to CH1, and recorded channel 2 is locked to CH2).

Selecting RF or IQ Playback

The IQC5000B is capable of I/Q baseband and RF playback. The I/Q Baseband playback is intended for normal use, RF playback capability should be used for testing and system validation only. Do not use RF Playback for normal use.

To play back a recording at an RF fixed frequency of 2.4GHz, select RF under Output. To play back baseband I/Q data to be mixed in an external vector signal generator, select IQ.

Setting Playback Loop Count

The loop count is how many times a selected file should be played. A loop count of 1 only plays the file once. A loop count of 2 will begin a second playback of the file immediately after the first playback has ended.

To change the loop count, enter the desired value in the Count box.

Setting Playback Start/Stop Positions

The start/stop positions dictate which portion of the file is played back. The default values represent a full file playback.

Enter the start and stop positions in the Start and Stop boxes, respectively. To specify time, use units ns, us, ms, M, or H (nanoseconds, microseconds, milliseconds, seconds, minutes or hours). To specify a sample length, enter the amount of samples without units to playback.

As an example, modifying the start position of a 5 second long file to 1s and the stop position to 3s will play the 2 seconds of the file after 1 second into the file.

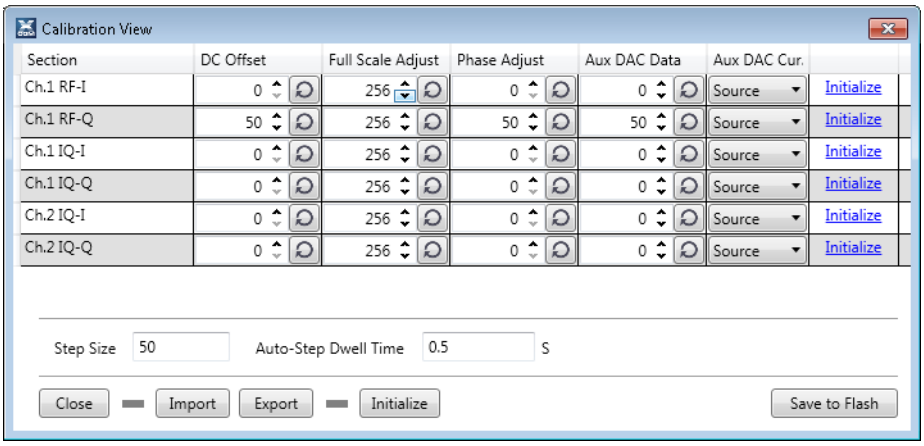
Setting the Playback Multiplier

The Playback Multiplier is an option to shift the bits of the outgoing data through the DAC. For low amplitude files, this makes better use of dynamic range. Unless it is known that a file is low amplitude, it's typically best to leave this option at x1.

Playback Calibration

Select the Calibration button to view the current RF and IQ playback calibration parameters on the IQC5000.

Figure 49 Playback Calibration Dialog



There are 3 I/Q pairs which correspond to the playback modes for each channel:

- Channel 1 RF – I, Q
- Channel 1 IQ – I, Q
- Channel 2 IQ – I, Q

The I and Q for each playback mode are calibrated separately, resulting in a total of 6 items to calibrate. Each item has 4 calibration parameters: DC offset, Full Scale Adjust, Phase Adjust, and Aux DAC Data.

Modifying Calibration Values

Each cell value can be modified by clicking in the cell and entering a value within the column parameter value range, automatically updating the IQC5000. Pressing the up and down arrows in the cell accomplishes the same thing; this method works well for manually calibrating the unit.

To save all calibration values to the IQC5000, select Save to Flash. The calibration values will not be saved to nonvolatile memory unless they are saved to flash.

Importing/Exporting Calibration Values

To import saved calibration values, select Import and navigate to the desired filepath. To export calibration values to a configuration file, select Export and navigate to the desired file path.

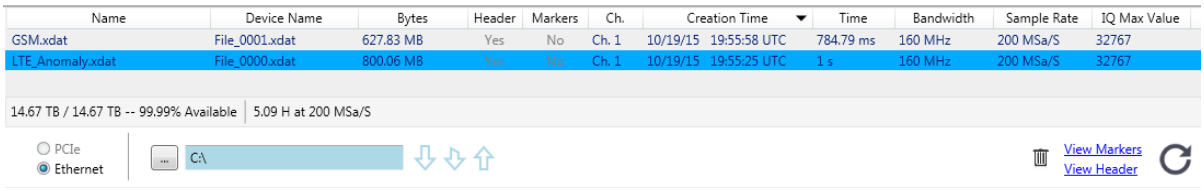
To load the manufacturer calibration values, import the default calibration file at:

%APPDATA%\XCOM\XCOMControl\config\IQCFlashConfig.xcfg.

File Management

Managing files on the IQC5000 storage is done in the File System pane on the bottom of the IQC5000 tab.

Figure 50 IQC Control File List

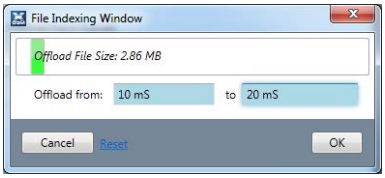


A list of the files currently on the device is displayed, sortable by clicking on the column headers.

Offloading Files

Offloading (downloading) is the transfer of files from the IQC-MEM storage to the Computer Workstation.

Figure 51 File Offload



Focusing on one or many files (via Ctrl+A or Ctrl+Mouse) enables the Offload icon ( ) and the Partial Offload icon ( ). With a partial offload, it is possible to specify a section of a file by start and end points in time or samples.

After the offload starts, the progress bar will update with the progress.

Set the Offload Directory on the Computer Workstation to the left of the offload icons.

For Microsoft® Windows 7™ users, the maximum supported operating system file size is 16TB. Because of this, IQC Control will automatically split files above16000000458752 bytes, to prevent operating system errors when offloading. Microsoft® Windows 8™ does not have this limitation.

Uploading Files

Uploading is the transfer of files from the Computer Workstation to the IQC-MEM storage. Uploading works much the same as offloading, except that the file transfer is in the opposite direction, and partial upload is not supported.

To upload a file, select the Upload icon ( ) and browse to the file to be uploaded. After the upload starts, the progress bar will update with the progress.

File Transfer Methods

The preferred method of file transfer is via the PCIe cable. Using the PCIe offload method is much faster than using Ethernet offload; so whenever it possible, it is advisable to use PCIe transfer. The option to use PCIe transfer will not be available unless a valid PCIe connection has been established with the IQC5000, thus Ethernet transfer will be selected by default if no PCIe connection detected.

As an alternative to offloading/uploading files with an IQC5000, the IQC5000B-MEM and external storage units can be attached directly to a workstation for very fast transfer speeds. To do so:

1. Connect the hardware as shown in Figure 6 on page 10 (the connection from the IQC5000B-MEM to the IQC5000 is not necessary).

2. Add a control tab as outlined in "Adding an IQC5000 to IQC Control" on page 42, selecting PCI Controlled as the control method.
3. Connect to IQC-MEM and offload/upload files.

Viewing File Information

Vital statistics and marker information for a recorded file can be viewed within the UI. Select the desired file in the file list, then click either View Markers or View Header (View Markers / View Header) in the lower right of the file list to view the Information.

Erasing the IQC5000 Memory

Focusing on one or many files (via Ctrl+A or Ctrl+Mouse) enables the Delete icon ( ). Clicking this icon will confirm the file names to be deleted, and carry out the deletion operation of each selected file.

During the erasure the progress bar in IQC Control will show the progress of the deletion, and the IQC5000 front panel will display the status.

Session Logs

The session log is an aggregation of environment variables, error messages, and server communications. Generate a session log when an error is encountered by navigating to Help > Create Session Log. The session log is key to helping Bird support identify the cause of the error. Session logs are saved in the directory %APPDATA%\XCOM\XCOMControl\logs.

Notifications

IQC Control incorporates a scale of user notifications to alert the user during operation of the IQC5000. Notifications range in severity from Good to Critical. Questions (user prompts) are also included.

구분	기호
심각	
경고	
정보	
좋음	
질문	

Notifications typically appear as a dialog box to the user after an event trigger. These notifications may be hidden from showing again by selecting the check box Don't show this message again in the lower-left corner of the dialog box.

The Notification Queue

After a notification has been selected for hiding, the notification does not appear as a dialog box, but instead appears in the Notification Queue in the upper-right corner of the device window. Note that some lower-priority notifications only appear in the Notification Queue.

Figure 52 Notification Queue

The Notification Queue shows the number of new notifications and the symbol of the highest severity item currently in the queue. Click View All to see a list of all the unviewed notifications, clear the queue, or view the notifications as they would normally appear in a dialog box.

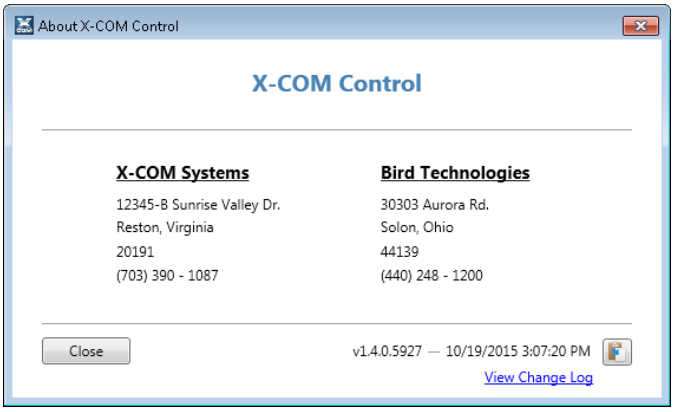
Managing Hidden Notifications

Notifications that have been hidden will remain hidden until reset by navigating to Tools > Settings > Disabled Dialogs. Here, all notifications can be reset by clicking Reset All Dialogs. Click View Disabled Dialogs to view the currently disabled notifications and to choose which single notifications to re-enable.

Viewing Software and Firmware Versions

The IQC Control Software Version can be viewed in the About menu, accessible at Help > About. The version number and build date can be found in the lower-right corner of the window.

Figure 53 About IQC Control Dialog Box



The IQC Control Change Log can be viewed by clicking View Change Log.

The IQC5000 Firmware Versions can be viewed by clicking on the Versions button at the bottom of the IQC5000 tab.

Chapter 5 Post Processing IQC5000 Recorded Data

IQC5000 Recording Files

When recordings are offloaded from the IQC5000, 3 separate files (6 for dual channel recordings) are generated with the following extensions:

- .xdat – Recording data file, 1 per channel(s) used during record
- .xhdr – Header file containing information about the recording (metadata)
- .xmrk – Marker data file containing time and location data

The xdat Data File

The .xdat data file is a binary data file with the following default format:

- I/Q Samples interleaved
- 16-bit integer I, 16-bit integer Q
- Signed, Two's Complement
- Little Endian

This and further information about the .xdat data file is recorded in the .xhdr header file.

The xhdr Header File

The .xhdr file is of XML 1.0 format and contains information about the recorded data. The format is detailed in Figure 54 on page 65.

> **Note:** *The .xhdr file should be parsed as XML, not strictly as text, as escape characters are used where the XML standard requires them.*

Figure 54 IQC5000 xhdr Header File Format

IQC5000 xhdr

Element LVL 1	Element LVL 2	Element LVL 3	Attribute	Range	Reso-lution	Default Unit	Default Value	Type	Description	Example
xcom_header			header_version				1.0		Version of X-COM header format	1.0
			name					string	User-assigned file name	Filename1
	device		type					string	Model	iqc5000
			ip					string	IP address	10.1.1.2
			mac					string	MAC address	000B79036116
		version	part	PPC Software, Media Controller FPGA, CPG Card FPGA, Software, RIF Module FPGA, RIF IO Processor, Engineering UI, Software				string	Sub parts of the system; not included for front panel recordings; RIF items not included for BLD recordings	Media Controller FPGA
			code	Dependent on 'part'				string	Firmware/Software version	20130603
	captures	capture	name	256 char. max				string	SA parameters, including model and firmware revision	TEKTRONIX,RSA6120B,B030135, FV:2.6.2070
			channel	1, 2	1		1	byte	Channel that header corresponds to	1
			center_frequency	0 - 44100000000	1	Hz		double	SA RF center frequency	140000000
			acq_scale_factor					float	Scale factor acquired from the SA; used to convert back to real power	58.7624818807E-12
			data_scale_factor					float	Scale factor saved to header by post-processing software like Spectro-X	58.7624818807E-12
			attenuation	0 - 100	1	dB		int	Input attenuation on SA	10
			acquisition_bandwidth	100 - 110000000	1	Hz	110000000	uint64	Frequency range of the signal	110000000
			sample_rate	10000 - 50000000000	1	Hz	150000000	uint64	Clock rate of ADC	150000000
			start_capture	2012-9999:001-366:00-23:00-59:00-59.000000-999999				YYYY:DDD:HH:MM:SS.mmmuuu	Time first sample of data arrives	2013:269:17:50:54:166097
			stop_capture	2012-9999:001-366:00-23:00-59:00-59.000000-999999				YYYY:DDD:HH:MM:SS.mmmuuu	Stop recording timestamp	2013:269:17:50:54:166097
			creation_time	2012-9999:001-366:00-23:00-59:00-59.000000-999999				YYYY:DDD:HH:MM:SS.mmmuuu	Time file is created on IQC; differs from start_capture for recordings waiting for trigger	2012:253:18:21:30:000
			timestamp_source	IRIG, NMEA, PC, RTC		IRIG		string	Source of timestamp	IRIG
			time_calibration	2012-9999:001-366:00-23:00-59:00-59.000000-999999				YYYY:DDD:HH:MM:SS.mmmuuu	Time of calibration	2013:269:17:50:54:166097
			iq_max_value	0-32767	1			short	Largest magnitude number in the recording	5786
	data_files	data	name	256 char. max				string	User-assigned file name - will carry suffix of channel if multiple channels are used for recording	Filename1_ch2.xdat
			channel_count	1 - 2	1	channel	1	byte	# of channels used while recording	2
			sample_resolution	8 - 64	8	bit	16	byte	Bits per sample	16
			iq_interleave	True/False			True	boolean	Interleaved I/Q samples	True
			little_endian	True/False			True	boolean	Little/Big endian	True
			protected	True/False			False	boolean	Protected from delete	False
			signed_type	True/False			True	boolean	Signed or unsigned	True
			data_encoding	See Description			int16	string	[u]int[8-64], Float: float (32-bit float), double (64-bit float), IEEE notation	int16
			samples		1	sample			Amount of samples	279000
	marker_files	marker	name	256 char. max				string	Marker file name	File1.xmrk
			format	XML, BIN1, BIN2			XML	string	Marker file format	XML
			count	1 - 100000	1		1		Amount of markers	20000
	comments		comments	1024 char. max				string	User-entered text to describe the recording	

Listed in the following sections are further descriptions of notable header parameters:

acq_scale_factor

The acquisition scale factor is the floating point number that must be multiplied with each I and Q two byte signed integer sample to convert that sample back to the voltage measured on the signal analyzer. Knowing the actual voltage level of the signal is critical when making accurate measurements, and when playing back that signal.

In RSA recordings, a 32-bit I and Q representation of that floating point number is parsed from the RSA. So for use with the IQC, the scale factor must be adjusted by 2^16 because the calculation is based on separate I or Q values.

Converting a Recorded Sample to Voltage

To convert a recorded I or Q sample to voltage:

$$Ivoltage = Isample \times SCF \times 65536$$

$$Qvoltage = Qsample \times SCF \times 65536$$

Where:

Ivoltage, Qvoltage = the voltage level for the I or Q sample

Isample, Qsample = the 16-bit sample I or Q value

SCF = the 32-bit scale factor

Converting a Recording to Power (dBm)

Once the I and Q voltages are known, the samples can be converted to power in dBm:

$$Pdbm = 20log\left(\frac{\sqrt{Ivoltage^2 + Qvoltage^2}}{0.22360679 \times \sqrt{2}}\right)$$

Where:

PdBm = power in dBm

Ivoltage, Qvoltage = the voltage level for the I or Q sample

Converting a Recording to Power (dB)

Once the I and Q voltages are known, the samples can be converted to power in dB:

$$Pdb = 20log\sqrt{Ivoltage^2 + Qvoltage^2}$$

Where:

PdB = power in dB

Ivoltage, Qvoltage = the voltage level for the I or Q sample

marker_files

The element marker_files will only have a sub-element marker when markers have been recorded – otherwise, there will be no marker sub-element.

The xmrk Marker File

The .xmrk marker file is generated when a TTL-level trigger is received through the Marker 1 or Marker 2 inputs on the rear of the IQC5000, or by pressing the MARK button on the front panel of the IQC5000. A marker file is not generated if no markers are received.

The default .xmrk marker file format is XML 1.0, detailed in Figure 55 on page 67.

If accessing a IQC-MEM external storage unit directly (that is, without downloading the recording through IQC Control), the .xmrk file will be of the binary format BIN2, detailed in Figure 56 on page 67.

See "Markers" on page 35 for more information on recording with markers.

Figure 55 The IQC5000 xmrk Marker File Format – XML

IQC5000 xmrk - XML

Element LVL 1	Element LVL 2	Attribute	Range	GPS Only	Reso-lution	Default Unit	Type	Description	Example
xcom_markers	marker	marker_number	0 - 100000		1	marker		Marker number	330
		absolute_sample_number			1	sample		Sample number from recording begin sample	48639756
		timestamp	2012-9999:001-366:00-23:00-59:00-59.000000-999999				YYYY:DDD:HH:MM:SS.mmmuuu	Timestamp associated with absolute_sample_number	2013:269:17:50:54.099826
		timestamp_source	NMEA, IRIG, RTC, PC					Source of timestamp	NMEA
		latitude	00-90°00-59.9999'	X			DD°MM.MMMM'	0-90° with minutes and fractions of minutes	38°56.9621'
		latitude_direction	N, S	X				North/South coordinate	N
		longitude	000-180°00-59.9999'	X			DDD°MM.MMMM'	0-180° with minutes and fractions of minutes	077°22.2818'
		longitude_direction	E, W	X				East/West coordinate	W
		altitude	00000 - 99999	X				Meters above mean sea level	00121
		speed	000.0 - 999.9	X				Speed in knots	000.0
		event_code	front_panel, marker1_rising, marker1_falling, marker2_rising, marker2_falling,					Stimulus logic that caused the marker to be inserted into the recording; multiple stimuli are delimited by vertical bar (if multiple stimuli are received for a single marker)	'marker1_rising|marker2_falling

Figure 56 The IQC5000 xmrk Marker File Format – BIN2

IQC5000 xmrk - BIN2

Field	Width	Bits (Little Endian)	BCD	Description, Format
Marker Number	18	287-270		Marker number
Spare	6	269-264		(Unused)
Event Code	8	263-256		00010000 = marker2_falling 00001000 = marker2_rising 00000100 = marker1_falling 00000010 = marker1_rising 00000001 = front_panel
Absolute Sample Number	64	255-192		Sample number from recording begin sample
Timestamp	68	191-124	X	YYDDDHHMMSSmmmuuu (Year, Day, Hour, Minute, Second, millisecond, microsecond)
Timestamp Valid	1	123		1 = valid, 0 = not valid
Timestamp source	2	122-121		11 = IRIG 10 = NMEA 01 = PC
GPS Data Valid	1	120		1 = both position and speed valid
Latitude	32	119-88	X	LLLLtttt (decimal number LLLL.tttt)
Latitude Direction	8	87-80		ASCII value, "N" or "S"
Longitude	36	79-44	X	LLLLLtttt (decimal number LLLLL.tttt)
Longitude Direction	8	43-36		ASCII value, "E" or "W"
Altitude	20	35-16	X	AAAAA - in meters
Speed	16	15-0	X	SSSt (decimal number SSS.t) - in knots

Example xmrk XML File

<?xml version="1.0" encoding="utf-8"?>

<xcom_markers>

<marker marker_number="0" absolute_sample_number="81390" timestamp="2014:013:19:55:41.635163" timestamp_source="IRIG" latitude="38°56.9636'" latitude_direction="N" longitude="077°22.2888'" longitude_direction="W" altitude="00120" speed="000.0" event_code="marker1_rising"/>

<marker marker_number="1" absolute_sample_number="181388" timestamp="2014:013:19:55:41.637163" timestamp_source="IRIG" latitude="38°56.9636'" latitude_direction="N" longitude="077°22.2888'" longitude_direction="W" altitude="00120" speed="000.0" event_code="marker1_rising"/>

<marker marker_number="2" absolute_sample_number="281390" timestamp="2014:013:19:55:41.639162" timestamp_source="IRIG" latitude="38°56.9636'" latitude_direction="N" longitude="077°22.2888'" longitude_direction="W" altitude="00120" speed="000.0" event_code="marker1_rising"/>

<marker marker_number="3" absolute_sample_number="381392" timestamp="2014:013:19:55:41.641156" timestamp_source="IRIG" latitude="38°56.9636'" latitude_direction="N" longitude="077°22.2888'" longitude_direction="W" altitude="00120" speed="000.0" event_code="marker1_rising"/>

</xcom_markers>

The preceding example XML marker file has 4 markers, beginning at marker_number 0 and ending at marker_number 3.

A marker was produced roughly every 2 ms, as illustrated by the differences in the timestamps. (Dividing the difference in absolute_sample_number by the sample_rate located in the header file will also equal delta time.)

The presence of location data (latitude, latitude_direction, longitude, longitude_direction, altitude, and speed) indicates that a GPS device was connected.

The timestamp_source indicates that an IRIG device was used in addition to GPS. Due to its higher precision, IRIG time is used over NMEA time when both are present.

The recording was made while stationary, illustrated by the speed remaining at 0 and the latitude/longitude never changing.

The event_code values show a pattern of markers with the rising edge of marker 1 followed by the falling edge of marker 1. This coupled with the regular delta between timestamps of 2ms suggests that a 250Hz 50% duty cycle square wave was used to stimulate markers.

The IQC5000 error log file can be accessed from within IQC Control by navigating to Help > Logs > View Current Error Log. If any unexpected behavior occurs during use of the IQC5000, consult the error log first for a descriptive error message.

If the unexpected behavior cannot be resolved, generate a session log as outlined in "Session Logs" on page 62 and provide Bird support with the error and session logs.

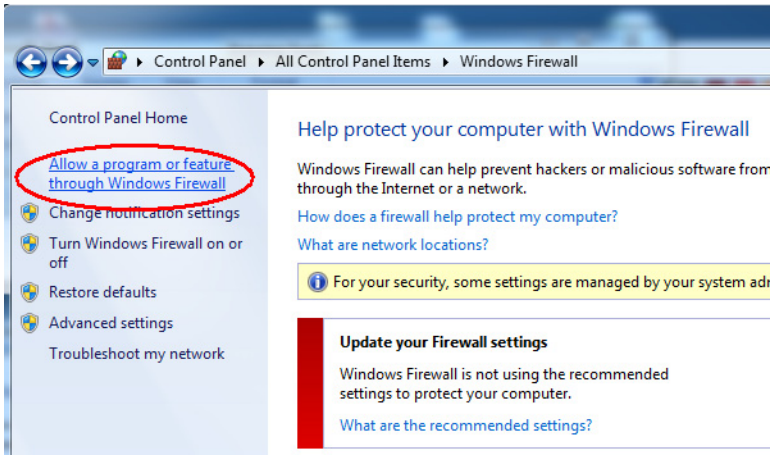
Connection Problems

Unable to Connect to Devices through IQC Control Software

If you experience difficulty connecting to either the IQC5000 or RSA when using the IQC Control software, check that all antivirus/firewall software (proprietary and stock) allows communication.

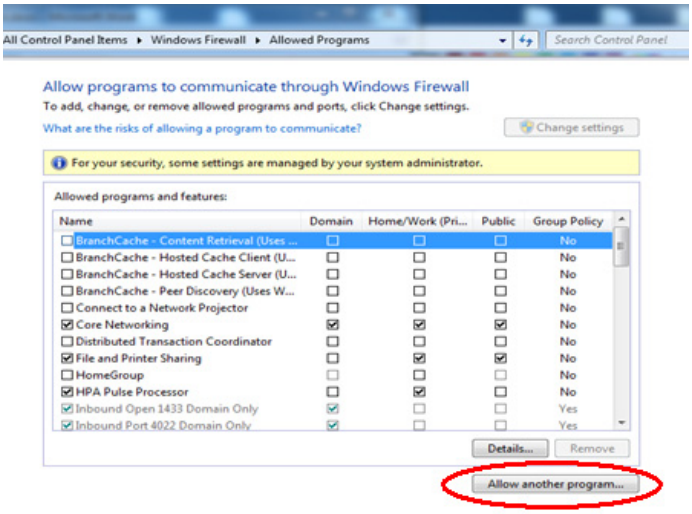
1. Allow IQC Control through Microsoft® Windows™ Firewall (this is done initially as part of the installation routine, but if for some reason it has been removed, follow these steps).
    a. Acquire administrative privileges.
    b. Navigate to Control Panel > Windows Firewall.
    c. On the left side of this window, click Allow a program or feature through Windows Firewall.

Figure 57 Windows Firewall



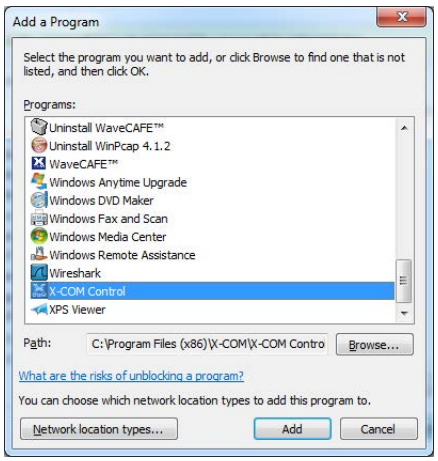
    d. In the Program Selection window, click Allow another program...

Figure 58 Windows Firewall Authorized Programs



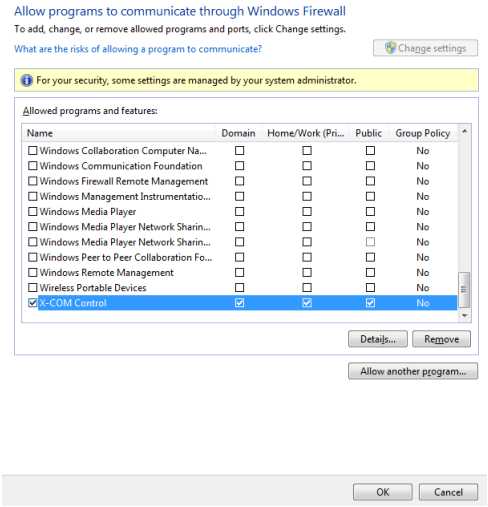
e. Next, scroll down to IQC Control and click Add.

Figure 59 Add an Authorized Program to Windows Firewall



f. Next, select all networks in the allowed features window.

Figure 60 Authorize IQC Control for Windows Firewall



g. Click OK and exit from all firewall and Control Panel windows.

Rohde and Schwarz

DigIConf Will Not Start or Freezes Immediately After Starting

If the Rohde and Schwarz EX-IQ USB cable is moved between control workstations, this may cause the EX-IQ drivers to fail. This may also happen during prolonged use of the EX-IQ. When this happens, DigIConf will typically fail to start correctly. To fix this:

1. Restart the Computer Workstation.
2. Make sure that the USB cable is plugged into a USB 2.0 port on the Computer Workstation instead of a USB 3.0 port. Issues connecting to the EX-IQ have been noted when using USB 3.0.
3. Unplug and re-insert the USB cable.

IQC Control Cannot Connect to FSV/FSW, Failure Connecting to EX-IQ

Check that the firewall on the FSV/FSW is configured to allow DigIConf traffic from the Computer Workstation to the FSV/FSW, as outlined in "Configure Windows Firewall on the FSV/FSW to Allow DigIConf Traffic" on page 18.

Failure to connect to the Tektronix RSA SCPI Socket Server

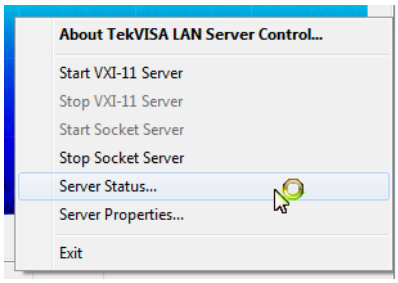
If an initial attempt to connect to the SCPI socket server on the RSA fails:

1. Verify SCPI socket server is running on the SA.

    a. Right-click on the TekVISA LAN Server Control icon in the system tray: 

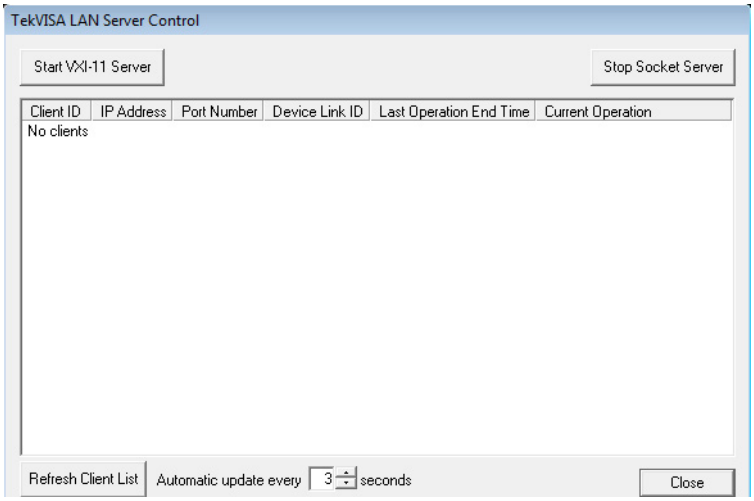
    b. Select Server Status from the menu that appears.

Figure 61 TekVISA Selection Dialog



    c. Verify Server is running displays in the lower-left corner of the window, and the button in the upper-right corner displays Stop Socket Server.

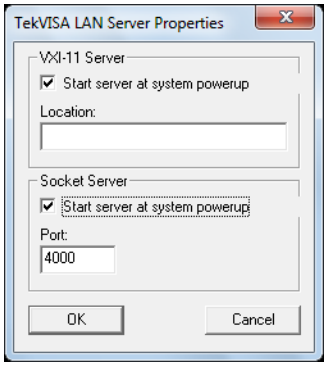
Figure 62 TekVISA Server Window



d. If the SCPI socket server is not running, the button in the upper-right corner should display Start Socket Server – press this button if this is the case.

2. If the SCPI socket server is already running, a restart of the SCPI socket server may be necessary to initiate communication.
   a. From the same window, toggle the button in the upper-right corner to stop, then start the SCPI socket server.
3. To start the socket server during power-on of the RSA:
   a. Right-click the TekVISA LAN Server Control icon in the system tray. Then click Server Properties.
   b. Next, under the Socket Server section, click the check box Start server at system powerup:

Figure 63 TekVISA LAN Server Properties



Updating the Firmware and Software for the IQC5000

The IQC Control software and IQC5000 firmware are packaged together into one installer. See "Installing the IQC Control Software and Loading the IQC5000 Firmware" on page 37

Building a RAID for Use with the IQC5000

External Storage Units purchased from Bird come pre-configured as ext2-formatted Linux mdadm software RAID0 arrays. The following instructions detail how to re-build the RAID in case of disaster.

A workstation with an LSI Host Bus Adapter (HBA) and running Linux with the mdadm package installed is necessary to format the RAID. All commands should be issued as root or via sudo.

Build the RAID0 Array Using mdadm

Issue the following command as root or sudo in a terminal session:

mdadm --create -c 512 -e 1.1 /dev/md1 -l0 -n**#** /dev/sd**[x-y]**

Where **#** is the total number of disks used in the External Storage Unit

And **[x-y]** is the drive assignment for the External Storage Unit drives

Example: For a External Storage Unit with 16 disks and drives assigned /dev/sdb through /dev/sdq the command would be: mdadm --create -c 512 -e 1.1 /dev/md1 -l0 -n**16** /dev/sd**[b-q]**

Format the External Storage Unit as ext2

Issue the following command as root or sudo in a terminal session:

mkfs.ext2 -m 0 -b 4096 -E stride=128 stripe-width=2048 /dev/md1

> **Note:** *If the External Storage Unit is larger than 15TB, the "-T largefile4" option should also be used.*
>
> **Note:** *stride= (mdadm chunk size[512k]/ filesystem block size[4k]) – should be 128.*
>
> **Note:** *stripe-width= (stride[128]*# of disks in array) – for a 16 disk External Storage Unit, stripe-width should be 2048.*

After the External Storage Unit has finished formatting, stop the External Storage Unit by issuing the following command:

mdadm --stop /dev/md1

Once the External Storage Unit has been stopped, it is safe to power off and disconnect from the workstation.

The External Storage Unit is now ready for normal use.

Routine Maintenance and Cleaning

To prevent the buildup of dust and keep air flowing as well as possible, a routine cleaning of the IQC5000 and peripheral devices every 3 months is recommended. A simple but thorough cleaning with a can of gas duster (canned air) around air inlets should be performed. The location of air inlets, further maintenance steps, and maintenance schedule are outlined in Table 27.

Before performing maintenance, power down each component.

Table 27 - Cleaning Instructions

Unit	Air Inlet Location	Cleaning Instructions	Schedule
IQC5000	Left and right sides	Clean air inlets with gas duster	Every 3 Months
IQC-MEM	Left and right sides	Clean air inlets with gas duster	Every 3 Months
External Storage Unit	Front and back	Clean air inlets with gas duster, making sure to open the front latch and spray the front latch filter from the inside out	Every 3 Months
		Check that retaining strip on inside of front latch has not shifted	Every 3 Months and after transport
		Check that drives are securely seated by firmly pushing each drive from the front	After transport
All other peripherals		Perform maintenance according to manufacturer's instructions	

System Temperatures

Important internal components are monitored for temperature via the IQC Control software. These values should be monitored to ensure system has proper cooling and to avoid overheating. The internal temperatures can be view of the System Tab in IQC control, see "System Temperatures" on page 48.

Sanitization Procedure

The following IQC5000 sanitization procedure covers data security requirements, details on nonvolatile memory components within the architecture of the device, and instructions on how to sanitize those components of all user data, information, and configuration settings.

Supported Products

The following Bird products are covered in the sanitization procedure:

- IQC5000B
- IQC-MEM
- IQC5000B-S08
- IQC5000B-S15

Terms and Terminology

The following terms are used in the sanitization procedure:

- Erase – Removes all data on a device or partition of a device and resets the entire address space to an erased state value
- Verify – A byte by byte comparison with either a known image or against the erased state value
- Nonvolatile memory – A memory device that retains information or data when the system is powered off
- User accessible – The user is able to directly access or retrieve the information stored within a memory device
- User modifiable – The user can initiate a write to a memory device during normal system operation

The following terminology is used in the table in the sanitization procedure:

- Data Input Methods
  - Software/Firmware Operations – A combination of software and firmware is used to control the type, quantity, and value of data or information stored
  - None – No method exists to collect data or store data to a device
- Type of User Info Stored – Describes the type of user information stored in the device
  - User data – Refers to waveforms or other measurement data representing signals connected to the instrument by users
  - User settings – Refers to instrument settings that can be changed by the user
  - None – No user settings or user data is stored in the device
- Method of Modification – describes how data is modified
  - Direct – The user can modify the data directly
  - Indirect – The IQC5000B system resources modify the data in a tightly controlled manner and that the user cannot modify the data outside of these control boundaries
  - None – No modification of this element can take place

Nonvolatile Memory Devices

Nonvolatile Memory Devices table lists the nonvolatile memory components of the products listed in "Supported Products" on page 76. Detailed procedures to sanitize these devices, if applicable, are may be found in the sections following the table.

Table 28 - Nonvolatile Memory Devices

Type	Function	Type of user info stored	Method of modification	Data input method	Location	User accessible or modifiable	To sanitize
FLASH	Fail Safe boot image	None	Indirect	Software/ Firmware operations	IQC5000B motherboard partition 0	No	Not applicable, does not contain user data or settings. However, the IQC sanitization utility will verify the contents of this FLASH partition including unused areas against a known image.
FLASH	Unused	None	None	Software/ Firmware operations	IQC5000B motherboard partition 1	No	Not applicable, does not contain user data or settings. However the IQC sanitization utility will erase and then verify this partition.
FLASH	Production boot image; factory configuration and calibration settings; network configuration settings	None	Indirect	Software/ Firmware operations	IQC5000B motherboard partition 2	Yes	The IQC sanitization utility will erase and then verify this partition and then restore the factory configuration and calibration settings and network configuration settings.
FLASH	Unused	None	None	Software/ Firmware operations	IQC5000B motherboard partition 3	No	Not applicable, does not contain user data or settings. However the IQC sanitization utility will erase and then verify this partition.
FLASH	Production boot image	None	Indirect	Software/ Firmware operations	IQC5000B playback board partition 0	No	Not applicable, does not contain user data or settings. However the IQC sanitization utility will erase and then verify this partition.
FLASH	Fail Safe boot image	None	Indirect	Software/ Firmware operations	IQC5000B playback board partition 1	No	Not applicable, does not contain user data or settings. However, the IQC sanitization utility will verify the contents of this FLASH partition including unused areas against a known image.

Type	Function	Type of user info stored	Method of modification	Data input method	Location	User accessible or modifiable	To sanitize
FLASH	Unused	None	Indirect	Software/ Firmware operations	IQC5000B playback board partition 2	No	Not applicable, does not contain user data or settings. However the IQC sanitization utility will erase and then verify this partition.
FLASH	Unused	None	Indirect	Software/ Firmware operations	IQC5000B playback board partition 3	No	Not applicable, does not contain user data or settings. However the IQC sanitization utility will erase and then verify this partition.
FLASH	Production boot image	None	Indirect	Software/ Firmware operations	IQC-MEM motherboard partition 0	No	Not applicable, does not contain user data or settings. Sanitizing would disable system functionality.
FLASH	Unused	None	None	None	IQC-MEM motherboard partition 1	No	Not applicable, does not contain user data or settings.
FLASH	Unused	None	None	None	IQC-MEM motherboard partition 2	No	Not applicable, does not contain user data or settings.
FLASH	Unused	None	None	None	IQC-MEM motherboard partition 3	No	Not applicable, does not contain user data or settings.
FLASH	Production boot image	None	Indirect	Software/ Firmware operations	IQC-MEM Hoyle	No	Not applicable, does not contain user data or settings. Erasing would disable system functionality.
FLASH	User files	User data	Indirect	Software/ Firmware operations	IQC5000B-ME2	Yes	Smelting in licensed furnace at or above 1600ºC.
External Storage	User Files	User data	Indirect	Software/ Firmware operations	IQC5000B-S08	Yes	Smelting in licensed furnace at or above 1600ºC.
External Storage	User Files	User data	Indirect	Software/ Firmware operations	IQC5000B-S15	Yes	Smelting in licensed furnace at or above 1600ºC.

Sanitization Procedure for IQC5000B & IQC5000B-MEM

When installing the IQC Control software for the first time on the control computer, it is necessary to perform a full firmware update of the IQC5000B system components. This will result in the creation of a configuration file containing the factory default configuration settings and calibration values. This file will be named flash_config_[Datetime].xcfg, where [Datetime] is the date and time the firmware upgrade takes place. the configuration file will be stored in the directory %APPDATA%\XCOM\XCOMControl\config\flash_configs\[IPv4Address], where [IPv4Address] is the IPv4 address of the IQC5000B unit. Take care to save this file in a safe location as it will be required for use with the sanitization utility.

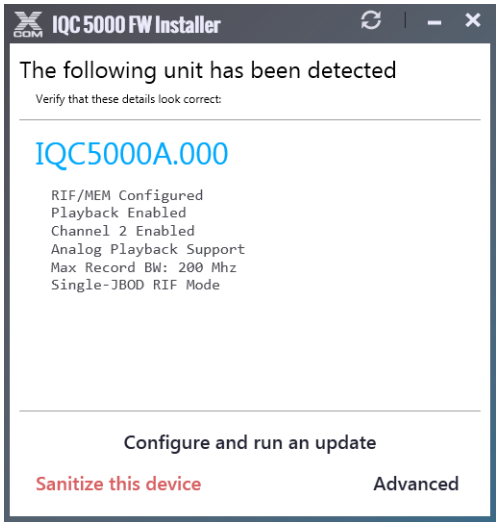
> **Note:** *Bird recommends that this file be permanently saved to nonvolatile medium such as a CD-R. The factory default flash configuration file is located in the \FlashConfig on the CD shipped with the IQC5000 system.*

A backup of the IQC5000B configuration settings is made every time the firmware installer is run, and every time the unit is sanitized.

Sanitization Procedure

1. Prior to sanitizing the IQC5000B and the IQC5000B-MEM, make sure that the IQC5000B-MEM is sleeping as described in "Sleeping/Waking the IQC5000B-MEM" on page 48.
2. Power down any and all external storage (i.e., IQC5000B-S08 or IQC5000B-S15) and physically disconnect them from the IQC5000B-MEM.
3. Start IQC Control.
4. Select **Tools > Run IQC Installer**. The software will exit and launch the firmware installer/sanitizer process.
5. Enter the IP address of the IQC5000B unit to be sanitized, or select the device from the list of previously connected devices.
6. Once connected to the IQC5000B, click Sanitize this device (see Figure 64).

Figure 64 IQC Firmware Update Window



7. Read the warning and acknowledge the sanitization procedure by selecting **Understood – Start Sanitization**.

   > **Note:** *The sanitization process is lengthy and may take as long as an hour to complete. Progress will be displayed in real time.*

8. After Sanitization is successfully completed, a dialog box will appear prompting for the system to be powered down.

9. Power down the IQC5000B and IQC5000B-MEM.
10. Select Exit to complete the sanitization procedure.

When finished, the IQC5000B and the IQC5000B-MEM are fully cleared of any and all user data, information, and configuration settings. Furthermore, the IQC5000B will power on in a Fail Safe mode and will require that production firmware be reinstalled in order to restore system functionality.

Restoring Functionality on the IQC5000B & IQC5000B-MEM

To reinstall the IQC5000B firmware and restore functionality to the IQC5000B & IQC5000B-MEM.

1. Power on the IQC5000B and IQC5000B-MEM.
2. Start IQC Control.
3. Select **Tools > Run IQC Installer**. The software will exit and launch the firmware installer/restore process.
4. Enter the IP address of the IQC5000B unit to be restored, or select the device from the list of previously connected devices.
5. Allow the installer to run.
6. When the IQC Firmware Update dialog box appears, enter the IP address of the IQC5000B and select Connect.
7. IQC control will detect the unit is in Fail Safe Mode. Select **Restore this device**. See Figure 65.

Figure 65 Restore from Fail Safe Mode

8. In the Device Restore dialog, the last back-up configuration file is pre-selected for the restoration process. If another configuration is desired, click the browse button and select the desired file.
9. Click **Ready - Restore Device**. See Figure 66 on page 81.

Figure 66 Device Restore

10. Allow the restoration is process to continue through to completion.

    Note: *Progress will be displayed in real time.*

11. After restoration is complete, click **Exit** to finish the process.

When complete, the IQC5000B will be restored to the original factory state.

Sanitization Procedure for IQC5000B-ME2, IQC5000B-S08 and IQC5000B-S15

Currently, Bird does not provide a non-destructive sanitization procedure for the solid state devices used in the external IQC5000B storage devices. Therefore, in order to sanitize these devices, at this time these devices can be sanitized by smelting in a licensed furnace at a temperature of at least 1600º C.

Chapter 9 Firmware Configuration Updates

The firmware updates described in this section are intended to support advanced features/options. These procedures are meant as additional options to those described in Chapter 4 "Using IQC5000 with IQC Control" on page 37.

Advanced RAID Configuration Modes

The IQC5000 supports enabling certain Features and/or Options using the Advanced option of the Firmware Installer.

Single and Dual RAID Mode

Single RAID Mode —(default configuration) Dual Channel operation with up to 150 MS/s sample rates.

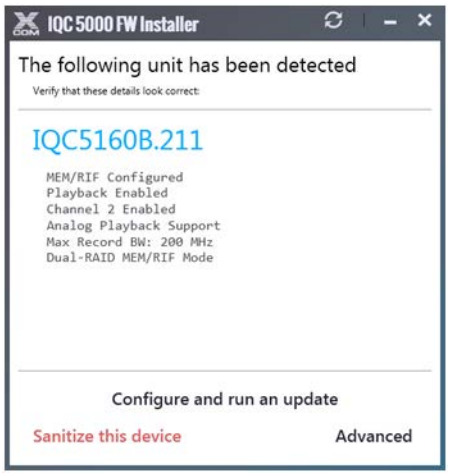
Dual RAID Mode —System must be configured for Dual RAID mode to support Dual Channel operation greater than 150 MS/s sample rates.

Firmware Upgrade

> **CAUTION**
> Formating RAIDs will erase existing data. Offload external storage unit or internal SSD RAID module recordings prior to performing this procedure.

1. Before installing the new firmware, offload any recordings that should be saved. After formatting the RAIDs in the new RAID mode, all data will be lost.
2. Run the installer IQC5000_setup_vW.X.Y.ZZZ.exe.
3. The firmware update message box will display:
    a. Enter the IP address of your IQC5000 in the IP Address text box and click the Connect button.
    Alternatively, if the device has previously been added as a tab in IQC Control select the device from the list at the bottom of the window.
4. Once the IQC5000 unit has been detected, select Advanced in the lower right corner of the dialog box. See Figure 67.

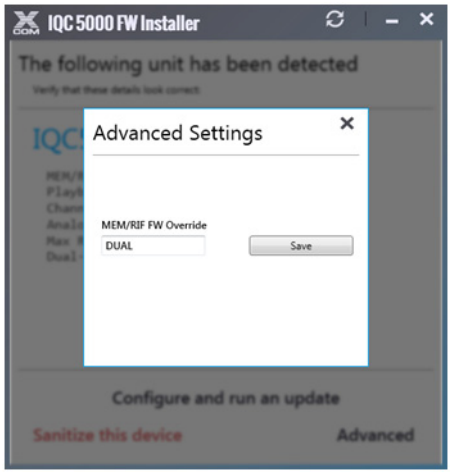
Figure 67 IQC Firmware, Advanced Selection



5. In the MEM/RIF FW Override field, enter one of the following codes. See Figure 68.
   - SINGLE - enter this code to switch from Dual RAID mode to Single RAID mode.
   - DUAL - enter this code to switch from Single RAID mode to Dual RAID mode.

   Note: *The codes must be entered in all caps, with no spaces or extra characters.*

Figure 68 Advanced Settings Selection Dialog



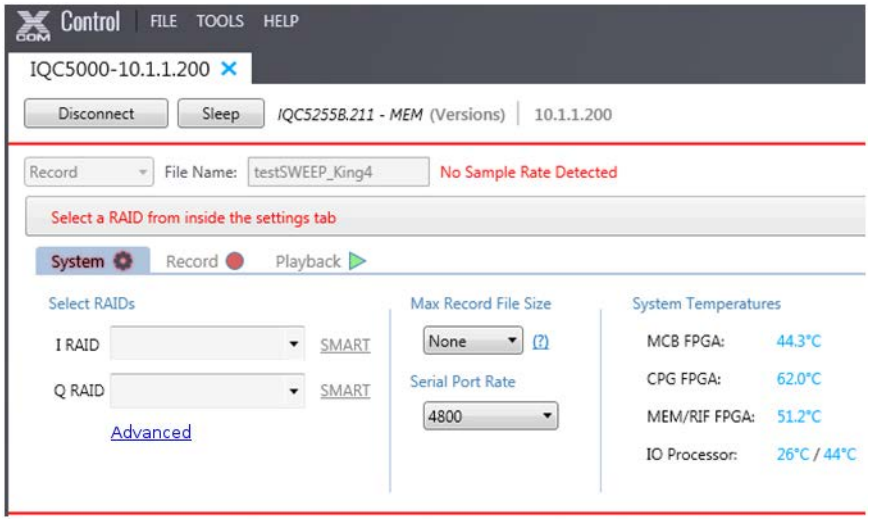
6. Click Save.
7. Select **Configure and run an update** on the Firmware Installer Dialog Box. See Figure 67 on page 82.
8. After the firmware installation process has finished, click OK to close the firmware installation.
9. Power off the IQC5000:
   a. If IQC-MEM is being used, the IQC-MEM module should be powered off first.
   b. Power off the IQC5000.
10. If IQC-MEM is being used with external storage units:
   a. Power on the external storage units and allow it to boot for 30 seconds.
   b. Power on the IQC-MEM module and allow it to boot for 30 seconds.
11. Power on the IQC5000.
12. Click Finish to close the installer.
13. Proceed with one of the following procedures:
   - "Dual RAID Formatting" on page 84.
   - "Single RAID Formatting" on page 86.

Dual RAID Formatting

Note: *This section applies to Dual RAID mode only.*

1. After the firmware is installed and the IQC-MEM(RIF) and IQC5000 have been power cycled, connect to the system in IQC Control.
2. (RIF Only) Select Wake Up to wake the RIF.
3. Select the System tab on IQC Control.
4. Under Select RAIDs, click Advanced. See Figure 69.

Figure 69 IQC Control – Dual RAID System Tab



5. If the system has previously been used in Single RAID mode, select the down arrow next to the existing RAID, on the right side of the window. Select Disassemble to disassemble the RAID.
   The drives that were once in the RAID should now show in the Available Media section.

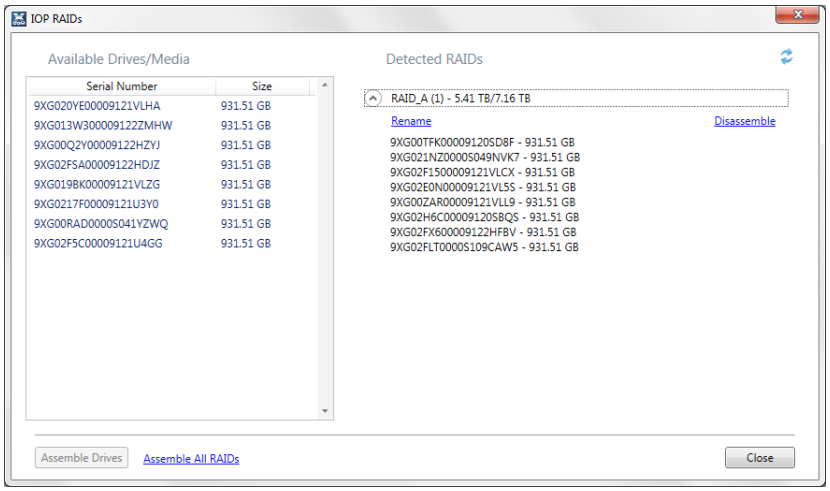
Assemble I RAID

6. Disconnect Secondary memory modules:
   a. If using internal ME2 memory with IQC-MEM, Unseat the ME2 memory module on the right-hand side of the unit. Pull the module out about 1-2 cm so it is no longer powered by the MEM chassis. See Figure 70.
   b. If using external storage units with IQC-MEM(RIF), disconnect external storage unit #2.

Figure 70 Unseated ME2 Module

7. Click on the refresh button  to update the Available Media in the IOP RAIDs Dialog. See Figure 71.

Figure 71 IOP RAIDs Dialog Box

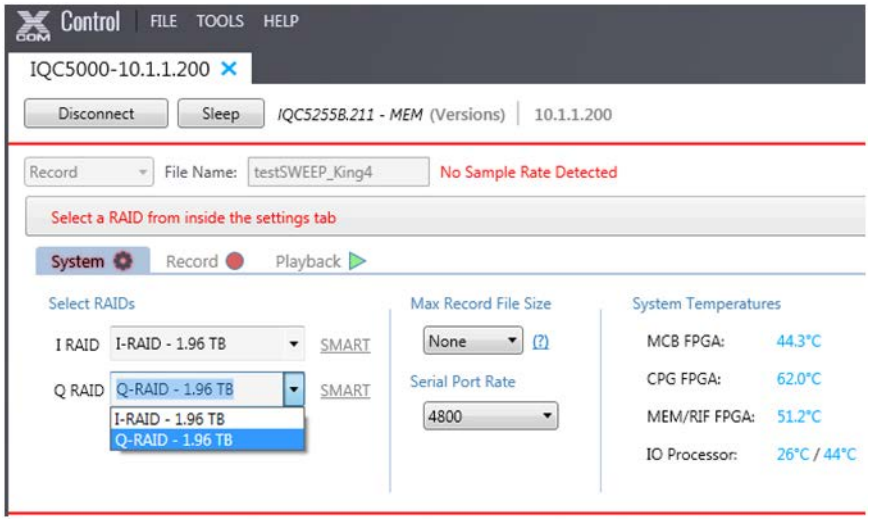


8. Select all of the remaining drives in Available Media.
   Select the first drive, hold down Shift, and click on the last drive.
9. Select Create new RAID with Selected Media.
10. Click Yes at the warning to commence formatting.
    This step will take about 2 minutes to complete.
11. When the formatting process has finished, name the newly created RAID with an “I” in the name, such as naming it “I-RAID”.
    Use the pull-down arrow to bring up the dialog “Enter Volume Name”.

Assemble Q RAID

12. Reconnect Secondary memory modules:
    a. If using internal ME2 memory with IQC-MEM, Insert the ME2 memory module on the right-hand side of the unit.
    b. If using external storage units with IQC-MEM(RIF), Reconnect external storage unit #2.
13. Click on the refresh button  to update the Available Media in the IOP RAIDs Dialog. See Figure 71.
14. Select all of the remaining drives in Available Media.
    Select the first drive, hold down Shift, and click on the last drive.
15. Select Create new RAID with Selected Media.
16. Click Yes at the warning to commence formatting.
    This step will take about 2 minutes to complete.
17. When the formatting process has finished, name the newly created RAID with an “Q” in the name, such as naming it “Q-RAID”.
    Use the pull-down arrow to bring up the dialog “Enter Volume Name”.
18. Close the IOP RAIDs Dialog Box.
19. Under Select RAIDs in the System tab, select the I RAID and Q RAID as they were named in steps 11 and 17. See Figure 72.

Figure 72 Select I and Q RAIDs



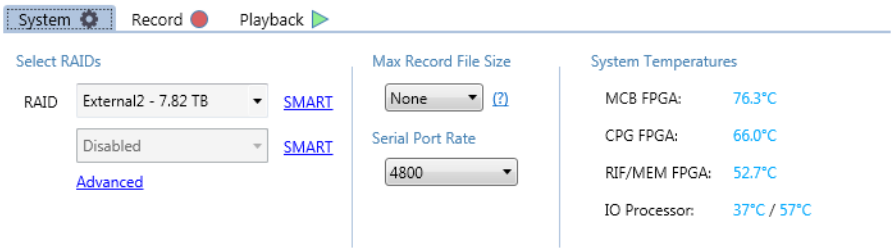
20. The IQC5000 system is now configured for dual RAID operation. Refer to Chapter 3 "Operating Instructions" on page 26 to begin using the IQC5000.

Single RAID Formatting

Note: *This section applies to Single RAID mode only.*

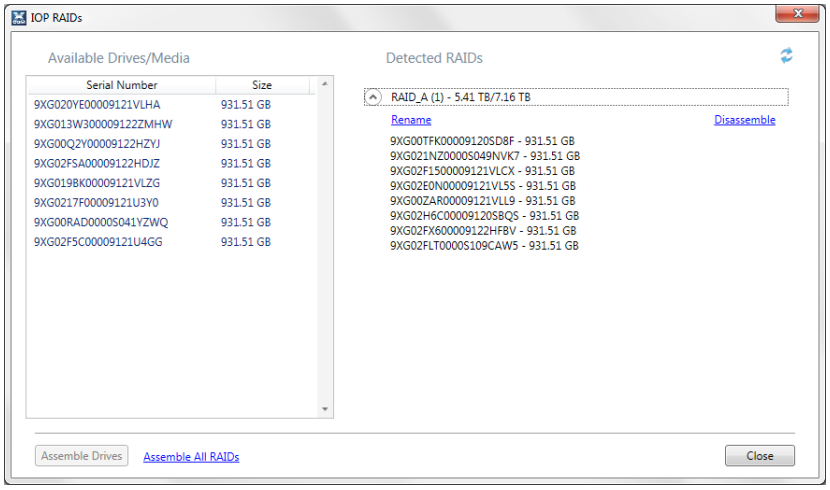
1. After the firmware is installed and the IQC-MEM(RIF) and IQC5000 have been power cycled, connect to the system in IQC Control.
2. (RIF Only) Select Wake Up to wake the RIF.
3. Select the System tab on IQC Control.
4. Under Select RAIDs, click Advanced. See Figure 73.

Figure 73 IQC Control – Single RAID System Tab



5. If the system has previously been used in Dual RAID mode, select the down arrow next to each existing RAID, on the right side of the window. Select Disassemble to disassemble the RAIDs.
   The drives that were once in the RAID should now show in the Available Media section.
6. Select all of the drives in Available Media. See Figure 74.
   Select the first drive, hold down Shift, and click on the last drive.

Figure 74 IOP RAIDs Dialog Box



7. Select Create new RAID with Selected Media.
8. Click Yes at the warning to commence formatting.
   This step will take about 2 minutes to complete.
9. When the formatting process has finished, name the newly created RAID, as desired.
   Use the pull-down arrow to bring up the dialog “Enter Volume Name”.
10. Close the IOP RAIDs Dialog Box.
11. Under Select RAIDs in the System tab, select the RAID named in step 9. See Figure 73.
12. The IQC5000 system is now configured for Single RAID operation. Refer to Chapter 3 "Operating Instructions" on page 26 to begin using the IQC5000.

FCC Compliance—This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RF Recording Interface

I & Q Inputs

Specification	Value
Logic Level	LVDS
Sample Depth	16-bit I&Q
2 Channels of I&Q	Accepts both inputs simultaneously
Connector	Four 26-pin MDR
Maximum Data Rate (Mbytes/s)	600 at each connector
Spectrum Analyzer Compatibility	Keysight: N9010A/B, N9020A/B, N9030A/B, and N9040B Rohde & Schwarz: FSV, FSVR, and FSW Tektronix: RSA 5100/6100 Anritsu: Field Master Pro MS2090A
Minimum Span(kHz)	19.531
Span Resolution (kHz)	19.531
Maximum Acquisition Bandwidth (MHz)	110 (150 Msamples/s, 16 bits, I&Q) 160 (200 Msamples/s, 12 bits, I&Q) 255 (300 Msamples/s, 14 bits, I&Q)

Playback Interface

Analog I&Q Outputs

2 channels operating simultaneously, baseband, analog

Specification	Value
1-dB Bandwidth (MHz)	160 centered at 0 Hz
Power Level (dBm)	0 (fixed)
Amplitude Flatness across 110 MHz Bandwidth (dB)	+/-2
VSWR	≤ 1.8:1
Impedance (ohms)	50
Connector	SMA Female

RF Outputs

RF playback capability should be used for testing and system validation only. Do not use RF Playback for normal use.

Channel 1

Specification	Value
Center Frequency (MHz)	2400
Information Bandwidth (MHz)	160
Power Level (dBm)	0 to -60 in 1-dB steps
LO Leakage (dBm)	-60
VSWR	≤ 1.8:1
Impedance (ohms)	50
Connector	SMA Female

General Specifications

GPS

Specification	Value
Protocol	ASCII, 8-bit data, one start and one stop bit, no parity
Speed (Kb/s)	Selectable: 4800, 9600, or 115200
Active Control Lines	RTS, CTS
Connector	9-pin D Female

IRIG-B

Specification	Value
Accuracy	IRIG-B122
Voltage Levels	Amplitude modulated, 3 Vpp, sine wave carrier
Read Rate	1/s
Maximum Number of Time Tags	100,000
Connector	SMA Female

Trigger Functions

Specification	Value
Number of Inputs	2
Voltage levels (VDC)	1 to 3 threshold, 5 maximum
Impedance (ohms)	50
Connector	SMA female
Latency from Trigger Valid to First Sample Write (µs)	<1
Re-Arm Time (ms)	<1
Pre-Record Memory (µs)	10
START/STOP RECORDING	
Record Types	Timed Manual
Port Configurations	Port 1 Port 2 Ports 1 and 2 Ports 1 or 2
Logic (User-Specified)	Leading Edge Valid Trailing Edge Valid (after start pulse or same pulse)
START/STOP PLAYBACK	
Playback Modes	Timed Manual Looped until Trigger Play between Markers
Port Configurations	Port 1 Port 2 Ports 1 and 2 Ports 1 or 2
Logic (User-Specified)	Leading Edge Valid Trailing Edge Valid (after start pulse or same pulse)

Markers

Specification	Value
Number of Inputs	2
Voltage levels (VDC)	1 to 3.3 threshold, 5 maximum
Impedance (ohms)	50
Connector	SMA Female
Maximum Allowed per Recording	100,000
Marker Content	Date Time of Day Latitude Longitude Altitude GS Sample Number
Latency (µs)	<1 from marker valid at connector to insertion in recorded file
Minimum Time between Markers (ms)	1

Reference Clocks

Specification	Value
INTERNAL	
Frequency (MHz, +/-ppm)	10, +/-10
EXTERNAL (Provided by external input port if active. Otherwise internal clock signal is used.)	
Required Level (dBm)	>0 into 50 ohms
Frequency (MHz, +/-ppm)	10, +/-10
Connector	SMA Female
Signal Type	Square or Sine

Waveform Storage

Specification	Value
Internal Solid State	NAND Flash
Internal Size (TBytes per unit (ME2))	2, maximum 2 units
External Rotating Magnetic	RAID 0
External Size (TBytes)	8, 15

Instrument Control

Specification	Value
IQC Control Software	Graphical User Interface Full Control of Recording Playback File Manipulation Offload and Upload
Operating Environment	Single-core desktop or laptop Microsoft® Windows 7™ or Windows 8™ 64-bit OS only Microsoft® Visual C++ 2013 x64 Redistributable Package Microsoft® .NET Framework 4.5.2 50 MBytes RAM 100 MBytes free disk space Mouse
Remote API	RJ-45 connection to LAN switch
Front Panel	Limited record and playback control (start, stop, record) via membrane switches and 2-line LCD

PCIe (Data Offload)

Specification	Value
Specification	2.0
Lanes – IQC-MEM	8

Environmental

MIL-PRF-28800F Class 3 except where noted by*

Specification	Value
Temperature	0° C to +50° C operating , -20° C* to +71° C storage. 95% relative humidity (non-condensing)
Vibration	Sinusoidal: 5 to 55 Hz, 0.33 mm amplitude. Random with solid-state drives installed: in conformance with MIL-PRF-28800F Class 3
Shock (non-operating)	30g

Power

Specification	Value
DC	12 VDC, 6 A maximum (72 W)

Dimensions

Specification	Value
Width x Height x Depth (in., mm)	12 x 3.5 x 10.5, 305 x 89 x 266
Weight (lb., kg)	8.5, 3.85

Product Conformity

Specification	Value
Electromagnetic Conformance	Directive 2014/30/EU, Electromagnetic Compatibility (EMC) EN 61326-1 and electrical equipment for measurement, control, and laboratory use ICES-003 Issue 5, August 2012 for a Class A device FCC Title 47 of the Code of Federal Regulations (CFR), Part 15 Subpart B for a Class A digital device KN 61000-4 KCC, Korean Standard for EMC Testing KN 32 KCC, Korean Standard for Electromagnetic Interference KN 35 KCC, Korean Standard for Electromagnetic Susceptibility
Electrical Safety Conformance	Directive 2014/35/EU, Electrical Equipment (Low Voltage) EN 61010-1:2010 - Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
RoHS Conformance	Directive 2011/65/EU, Restriction of Hazardous Substances

Customer Service

Any maintenance or service procedure beyond the scope of those in this chapter should be referred to a qualified service center.

If the unit needs to be returned for any reason, request an Return Material Authorization (RMA) through the Bird Technologies website. All instruments returned must be shipped prepaid and to the attention of the RMA number.

Bird Service Center
30303 Aurora Road
Cleveland (Solon), Ohio 44139-2794
Fax: (440) 248-5426
E-mail: *bsc@birdrf.com*

For the location of the Sales Office nearest you, visit our Web site at:

http://www.birdrf.com

Limited Warranty

All products manufactured by Seller are warranted to be free from defects in material and workmanship for a period of three (3) years, unless otherwise specified, from date of shipment and to conform to applicable specifications, drawings, blueprints and/or samples. Seller's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by Seller.

If Seller's products are claimed to be defective in material or workmanship or not to conform to specifications, drawings, blueprints and/or samples, Seller shall, upon prompt notice thereof, either examine the products where they are located or issue shipping instructions for return to Seller (transportation-charges prepaid by Buyer). In the event any of our products are proved to be other than as warranted, transportation costs (cheapest way) to and from Seller's plant, will be borne by Seller and reimbursement or credit will be made for amounts so expended by Buyer. Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing within ten days from the date of discovery of the defect.

The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's request and/or to Buyer's specifications. Routine (regularly required) calibration is not covered under this limited warranty. In addition, Seller's warranties do not extend to the failure of tubes, transistors, fuses and batteries, or to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to Seller.

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Glossary

Acq BW: Acquisition Bandwidth
API: Application Programming Interface

CF: Center Frequency

dB: Decibel(s)
dBm: Decibel(s), with respect to 1 milliWatt

FW: Firmware

GB: GigaBytes (1,000,000,000 decimal bytes)
GUI: Graphical User Interface

HBA: Host Bus Adapter
HDD: Hard Disk Drive

I & Q: In-Phase and Quadrature

LVDS: Low-voltage differential signaling, also known as TIA/EIA-644, is a technical standard that specifies electrical characteristics of a differential, serial communications protocol. LVDS operates at low power and can run at very high speeds.

ms: millisecond(s)
MSa/s: Mega Samples per second

NIC: Network Interface Card
ns: nanosecond(s)

PCIe: PCI (Peripheral Component Interconnect) Express

RAID: Redundant Array of Independent Disks
RF: Radio Frequency

s: second
SA: Signal Analyzer
SSD: Solid State Drive
SW: Software

TTL: Transistor-Transistor Logic

VM: Virtual Machine
VSG: Vector Signal Generator

µs: microseconds