FC-900 Interface Manual
for the RC96/85 Repeater Controller

(command codes censored to protect owners)

Introduction
The FC-900 Interface connects ACC's repeater controller products to the ICOM IC-900A Super Multi-Bander System band units for an easy-to-hook-up remote base or link installation.

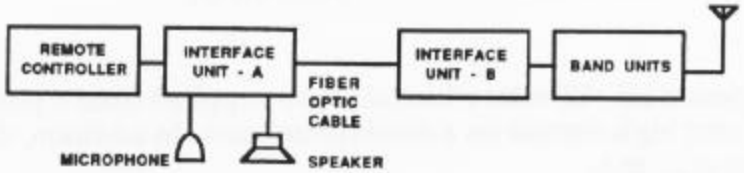
The FC-900 provides the hardware interface to the IC-900 band units, replacing the ICOM Interface Units A and B in this application. In addition, the FC-900 can recover expanded remote control output functions (UF outputs) for the controllers which may be used for antenna selection and other external control functions.

ICOM IC-900 System Description
The IC-900 Super-Multibander System is a modular mobile transceiver system which provides trunk-mounted rf decks (band units), dash mounted remote controller, and a fiber-optic link with associated interface units. Available band units cover six amateur bands from 29 MHz to 1300 MHz.

A small keyboard and LCD display remote controller is intended for visor mount in the car. Interface Units A and B provide a fiber optic cable interface between the remote controller and the band units located in the trunk.

The IC-900 system architecture supports two of up to six band units on at a time. The main unit is available for transmit and receive while the sub unit is receive-only. Cross-band full-duplex operation is permitted, transmitting on the main while receiving on the sub. Transmit is not permitted from the sub unit. There are no provisions for in-band full-duplex operation since each band unit is assigned a unique bus address.

IC-900 SYSTEM DIAGRAM



ACC Remote Base Description
In ACC's remote base application, the ICOM band units are interfaced to the repeater controller through the FC-900 unit. Interface Units A and B are not used. The FC-900 provides the electronic interface to the ICOM internal bus; transmit audio processing including pre-emphasis, symmetrical limiter, and level and deviation controls; receive audio processing including squelch pots for each band unit, de-emphasis, and squelch gating; programmable CTCSS encode; and recovery of seven general purpose remote control (UF) outputs.

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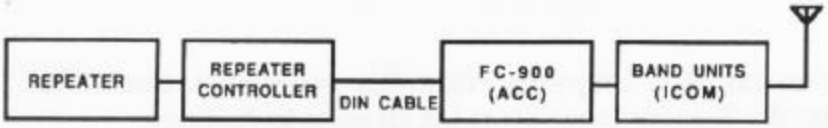
The controller software is responsible for controlling the internal circuitry of the band units, including the frequency synthesizer and other basic radio functions.

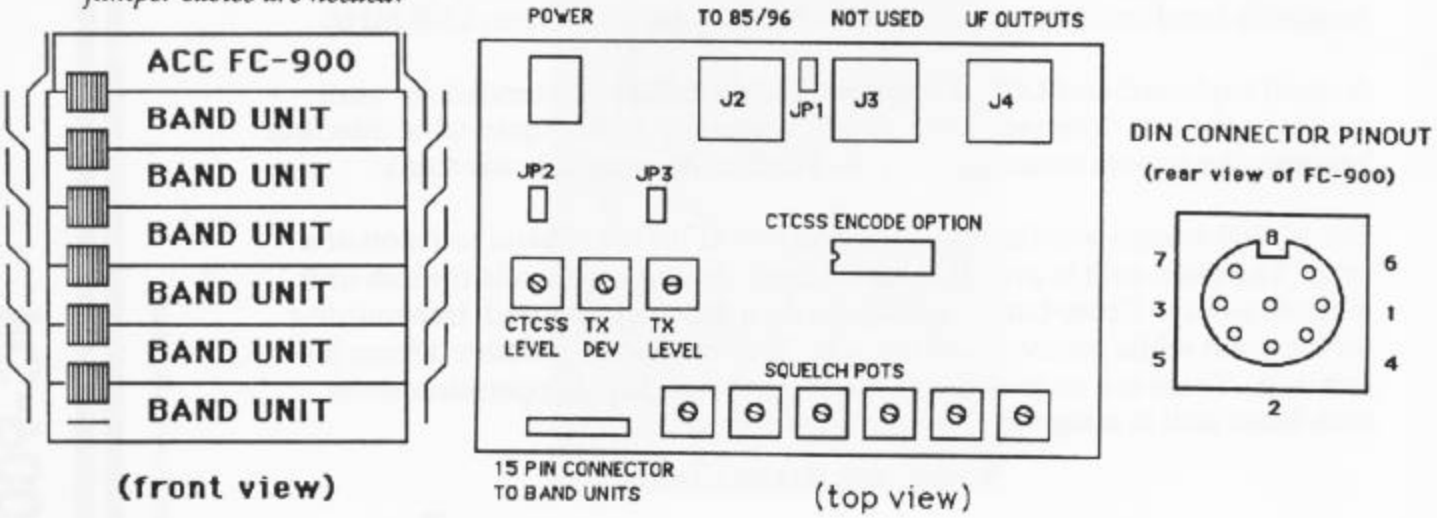
ACC REMOTE BASE SYSTEM DIAGRAM



Mechanical Hookup

The mechanical hookup of the FC-900 Interface is shown below. It mounts on the top of the stack of the available band units and bolts together using mounting brackets supplied with the band units. Use the ACC supplied screws for bolting in the FC-900. The mounting brackets should be configured as shown in the diagram.

The 15 pin cable supplied with each band unit connects it to the band unit mounted above it. The cable from the top band unit connects to the plug in the FC-900. The bottom connector of the bottom band unit does not connect to anything. The band units may be stacked in any order. *No additional mounting brackets or 15 pin jumper cables are needed.*



Power Supply

The ICOM band units operate off +12 volts which must be supplied from a power supply capable of supplying high current on a continuous basis. In addition, the FC-900 requires +12 volts at 25 mA.

Band Units

The band units are intended to plug into ICOM's Interface Unit B (which you don't have) which has six mating Molex power connectors. Instead, cables which mate to the band unit connectors are available through ICOM dealers, (ICOM part number OPC044A). Alternatively, a power bus may be wired using mating Molex connectors or pins. The mating connectors are also available through ICOM dealers.

At most one unit will be in transmit and one in receive. Transmit current ranges from 1.5A (10M low power) to 9.5A (2M 45 watt high power). Refer to the specifications for your band units for details.

The low and high power levels of each band unit are internally adjustable. It may be desirable, depending on the application, air circulation and power available, to back down on one or both power levels (see band unit documentation). If extended high power operation is anticipated, consideration should be given to adding a fan for forced air cooling of the heat sinks. ICOM's CF-11 Cooling Fan Unit is not supported by the FC-900 interface.

FC-900 Interface
The FC-900 power connector is a barrel jack which is compatible with many wall mount power supplies (center pin positive!). Alternatively, the supplied barrel plug may be wired to your 12 volt power supply.

Connection to Controller

RC-96 Controller. The FC-900 interface connects directly to the RC-96 controller through a supplied one-to-one DIN cable, from RC-96 LINK connector to the FC-900 J2 connector.

RC-85 Controller. Connection to the RC-85 controller requires wiring one end of the supplied DIN cable to the controller's Molex connectors as shown below. (Verify wire color vs. pinout with an ohmmeter.)

J2 DIN Pin #	Color	RC-85 Signal	RC-85 Connector/Pin
1	black	Link Receiver COS	J3-2
2	brown	Ground	J4-1
3	red	CX1	J3-12
4	orange	CX3	J3-11
5	yellow	CX2	J3-9
6	green	Transmitter Audio	J4-8
7	blue	Link Receiver Audio	J4-6
8	white	-	
SHIELD	tinned wire	Ground	J3-14

Adjustments

Several adjustments must be made after installation. Because the band units must be operating to make the adjustments, it will be necessary to read ahead to learn how to command the transceivers. The adjustments are straightforward to make after the units are turned on.

Squelch Pots – Pots R104-R109 are adjusted for the desired squelch setting when the respective band unit is selected. Bring up the band unit in receive-only and adjust the respective pot (each pot is labeled on the board by band).

Transmit Level – R103 adjusts the level of the transmit audio applied to the limiter in the FC-900. It should be adjusted so that transmit audio just enters clipping (at the cathode of CR5). With the RC-96 controller, if the transmit audio level out of the controller is very low, it may be necessary to clip jumper JP3 to increase the input gain to approach clipping.

Transmit Deviation – R102 determines the amplitude of limited audio applied to the modulators in the band units. It should be adjusted for 3-5 kHz peak deviation.

CTCSS – R101 determines the level of the CTCSS signal applied to the modulator. It should be adjusted for ≈800 Hz deviation when a CTCSS tone is selected.

Link Receive Audio Level – Adjust RC-96 controller rear panel pot LRX, or RC-85 controller pot R2. Remember that Link 2 audio will be about half the level as Link 1 (this allows mixing link audios without blasting).

DIP Switches

As a reminder, *controller* DIP switches must be set properly to accomodate the FC-900 interface.

RC-85 Controller – 4, 5, 6 ON; 7 OFF.
RC-96 Controller – 4, 7 ON; 5, 6 OFF.

Jumpers

Jumpers JP1 and JP2 should be left installed. Jumper JP3 may need to be removed to increase input sensitivity (see Transmit Level section above).

Command Codes

The following sections describe the repeater controller commands which control the FC-900 interface and band units.

Band Selections

Users may select the desired band segment for Link 1 and Link 2. The band segment definition includes optional transmit offsets and legal frequency ranges. Selecting a band also turns the link on in receive-only mode. If a frequency out of the legal range is selected, the controller responds with "Frequency out of range" as a warning, but the dialed frequency *is* selected.

(Link Prefix) 1 x **Link 1 Band Select**
(Link Prefix) 2 x **Link 2 Band Select**

X	"Band"	Rx Frequency Range	Tx Offsets	Tx Frequency Range*	Band Unit
0	1240	1240.000 - 1249.995 MHz	S, ±12 MHz	1240.000 - 1261.995 MHz	UX-129A
1	10 meter	29.000 - 29.695 MHz	S, ±100 kHz	29.000 - 29.695 MHz	UX-19A
2	2 meter	144.000 - 147.995 MHz	S, ±600 kHz	144.000 - 147.995 MHz	UX-29A/H
3	220	220.000 - 224.995 MHz	S, ±1.6 MHz	220.000 - 224.995 MHz	UX-39A
4	440	440.000 - 449.995 MHz	S, ±5 MHz	438.000 - 449.995 MHz	UX-49A
5	430**	430.000 - 439.995 MHz	S, ±5 MHz	425.000 - 444.995 MHz	UX-49A
6	6 meter	50.000 - 53.995 MHz	S, ±1 MHz	50.000 - 53.995 MHz	UX-59A
7	420**	420.000 - 429.995 MHz	S, ±5 MHz	420.000 - 434.995 MHz	UX-49A
8	1280	1280.000 - 1289.995 MHz	S, ±12 MHz	1268.000 - 1299.995 MHz	UX-129A
9	1290	1290.000 - 1299.995 MHz	S, ±20 MHz	1270.000 - 1299.995 MHz	UX-129A
A	1270	1270.000 - 1279.995 MHz	S, ±20 MHz	1250.000 - 1299.995 MHz	UX-129A
B	1270	1270.000 - 1279.995 MHz	S, ±12 MHz	1258.000 - 1291.995 MHz	UX-129A
C	1250	1250.000 - 1259.995 MHz	S, ±12 MHz	1240.000 - 1271.995 MHz	UX-129A

* Transmit frequency range contains gaps - range indicated is intended to show limits. Add and subtract transmit offset to receive frequency ranges to determine transmit segments. Limited by amateur band edges.
**Warning: Neither ACC nor ICOM guarantees operation of band unit in these frequency ranges. Band units may require retuning. Success and performance may vary from band unit to band unit.

Receive-Only / Transmit / Off

Link 1 and 2 may be controlled independently. Transmit is permitted only from Link 1. Receive audio from Link 2 will be lower in level than Link 1 and will mix.

(Link Prefix) 1 – Link 1 On Receive Only
(Link Prefix) 2 – Link 1 Receive/Transmit
(Link Prefix) 3 – Link 1 Off
(Link Prefix) 4 – Link 2 On Receive Only
(Link Prefix) 6 – Link 2 Off

Frequency Selection

The frequency of Link 1 and Link 2 are selected with the following commands. "MHTOF" represents MHz, hundreds kHz, tens kHz, ones kHz, and offset (1/minus, 2/simplex, 3/plus) digits. The * (decimal point) and link specifier (1) are optional for Link 1.

(Link Prefix) (mhtof)	**Link 1 Frequency**
(Link Prefix) (m*htof)	**Link 1 Frequency**
(Link Prefix) 1 (m*htof)	**Link 1 Frequency**
(Link Prefix) 4 (m*htof)	**Link 2 Frequency**

Band Swap

The band segments assigned to Link 1 and 2 may be swapped. This permits quick access to transmit, which is permitted only from Link 1.

(Link Prefix) *	**Swap Link 1 / Link 2 Bands**

High/Low Power Select

The band units include provisions for high/low power selection.

Band Unit	Power Level
10M, 6M, 1200 MHz	10 or 1 Watt
2M, 220, 440 MHz	25 or 5 Watts
2M (UX-29H)	45 or 5 Watts

Commands are available for selecting high or low power remotely for Link 1.

Caution: Remember that the band units are intended for intermittent duty cycle. External cooling may be desirable. Keep this in mind when selecting high power.

(Link Prefix) 1 *	**Link 1 Power Interrogate**
(Link Prefix) 1 * 1	**Link 1 High Power**
(Link Prefix) 1 * 0	**Link 1 Low Power**

CTCSS Encode (Option)

A remotely selectable 37 tone CTCSS encoder is available as an option for the FC-900 interface. The encoder allows accessing repeaters which are set up for CTCSS access or control. The encoder option plugs into the IC socket at U7.

(Link Prefix) 7 xx	**CTCSS Select (00=off, 01-38=on)**

Note: The CTCSS encode *level* is adjusted using pot CTCSS LEVEL R101 on FC-900 board.

CTCSS FREQUENCIES							
01	67.0	**11**	-	**21**	136.5	**31**	192.8
02	71.9	**12**	100.0	**22**	141.3	**32**	203.5
03	74.4	**13**	103.5	**23**	146.2	**33**	210.7
04	77.0	**14**	107.2	**24**	151.4	**34**	218.1
05	79.7	**15**	110.9	**25**	156.7	**35**	225.7
06	82.5	**16**	114.8	**26**	162.2	**36**	233.6
07	85.4	**17**	118.8	**27**	167.9	**37**	241.8
08	88.5	**18**	123.0	**28**	173.8	**38**	250.3
09	91.5	**19**	127.3	**29**	179.9		
10	94.8	**20**	131.8	**30**	186.2		

Macro Set Storage

The repeater controllers have the ability to take "snapshots" of your controller setup, which are stored in "macro sets". Each macro set can be called up with a single control operator level command allowing instant selection of an entire group of parameters. The FC-900 support software (V4) integrates link and remote base information into the macro sets for quick selection of a link or remote base setup.

The information stored in the controller's macro sets include for each link:

- Off / receive-only / receive-transmit
- Band
- Frequency
- High / low power
- CTCSS encode on/off and tone

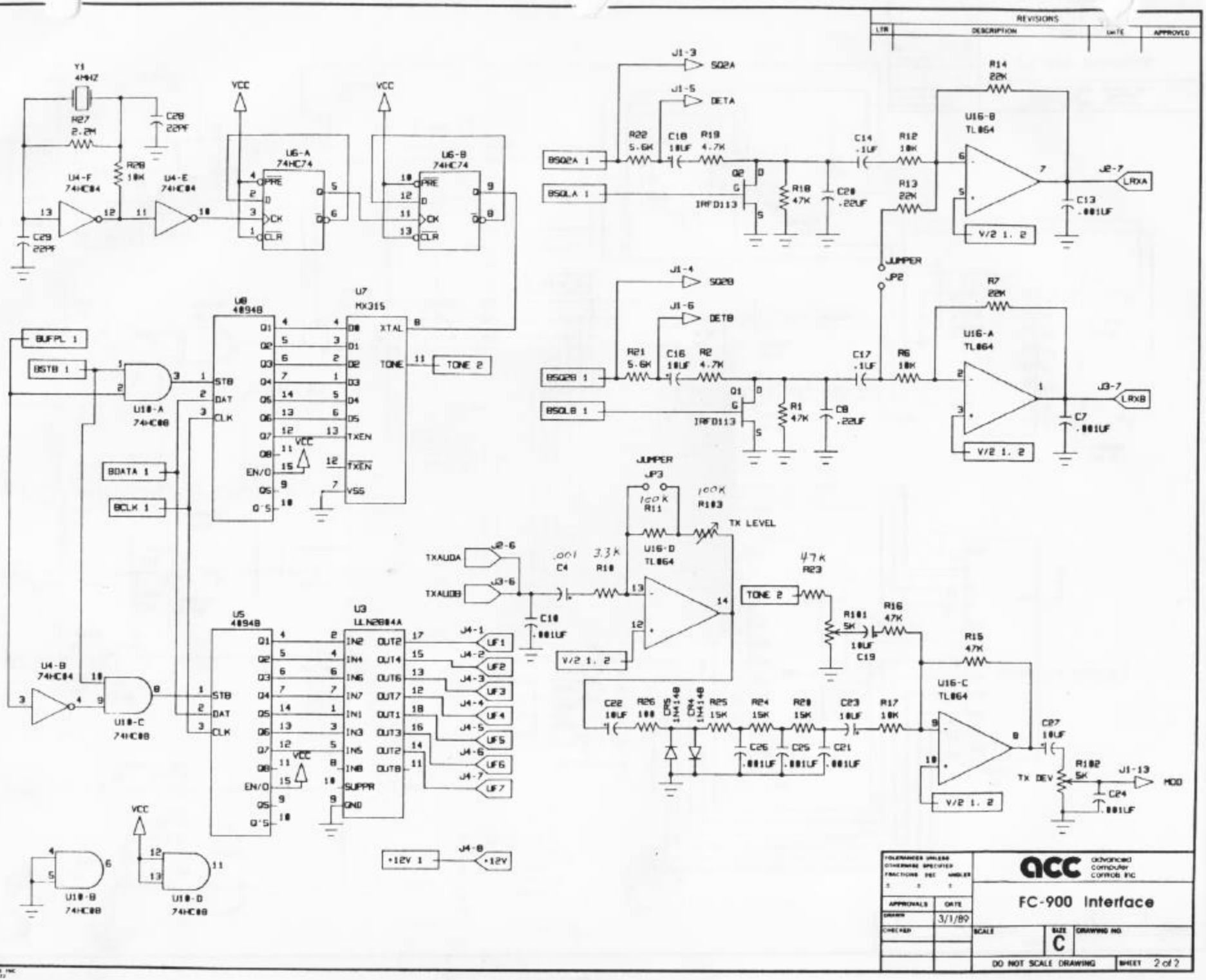
Recovering Expanded UF Outputs

In addition to controlling the IC-900 band units, the FC-900 Interface can recover seven expanded User Function remote control outputs supplied by the controllers. (The limitation to seven rather than eight is due to the seven bit width of the IC-900 control word.) The outputs are available at connector J1, with pinout shown below. Outputs are open collector and are low true. Miscellaneous functions described in the controller manual such as phone line busy output, external device strobe, etc. appear at these outputs.

Signal	Pin	Signal	Pin	
UF1	1	UF5	5	
UF2	2	UF6	6	
UF3	3	UF7	7	
UF4	4	+12 volts	8	(shield=ground)

Command Summary

(Link Prefix) 1	**Link 1 On Receive Only**
(Link Prefix) 2	**Link 1 Receive/Transmit**
(Link Prefix) 3	**Link 1 Off**
(Link Prefix) 4	**Link 2 On Receive Only**
(Link Prefix) 6	**Link 2 Off**
(Link Prefix) *	**Swap Link 1 / Link 2 Bands**
(Link Prefix) 1 x	**Link 1 Band Select**
(Link Prefix) 4 x	**Link 2 Band Select**
(Link Prefix) (mhtof)	**Link 1 Frequency**
(Link Prefix) (m*htof)	**Link 1 Frequency**
(Link Prefix) 1 (m*htof)	**Link 1 Frequency**
(Link Prefix) 4 (m*htof)	**Link 2 Frequency**
(Link Prefix) 1 *	**Link 1 Power Interrogate**
(Link Prefix) 1 * x	**Link 1 Power (x=1 high, x=0 low)**
(Link Prefix) 7 xx	**CTCSS Select (00=off, 01-38=on)**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22PF
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U4-E
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VCC
U6-A
74HC74
U6-B
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PRE
CK
CLR
J1-3
SQ2A
J1-5
DETA
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5.6K
C18
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R19
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BSQLA 1
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R12
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R2
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Q1
IRFD113
R1
47K
C8
.22UF
C17
.1UF
R6
10K
R7
22K
U16-A
TL064
J3-7
LRXB
C7
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V/2 1. 2
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U7
MX315
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BSTB 1
U18-A
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STB
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BCLK 1
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XTAL
TONE
TXEN
VSS
TONE 2
JUMPER
JP3
100K
R11
100K
R103
TX LEVEL
TXAUDA
TXAUDB
J2-6
J3-6
.001
C4
3.3K
R18
U16-D
TL064
47K
R23
TONE 2
R101
5K
C19
10UF
R16
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R15
47K
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U18-C
74HC08
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IN3
IN4
IN5
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IN7
IN8
OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
OUT7
OUT8
SUPPR
GND
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J4-2
J4-3
J4-4
J4-5
J4-6
J4-7
J4-8
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UF4
UF5
UF6
UF7
+12V
+12V 1
C22
10UF
R26
100
CR5
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CR4
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advanced computer control inc
FC-900 Interface
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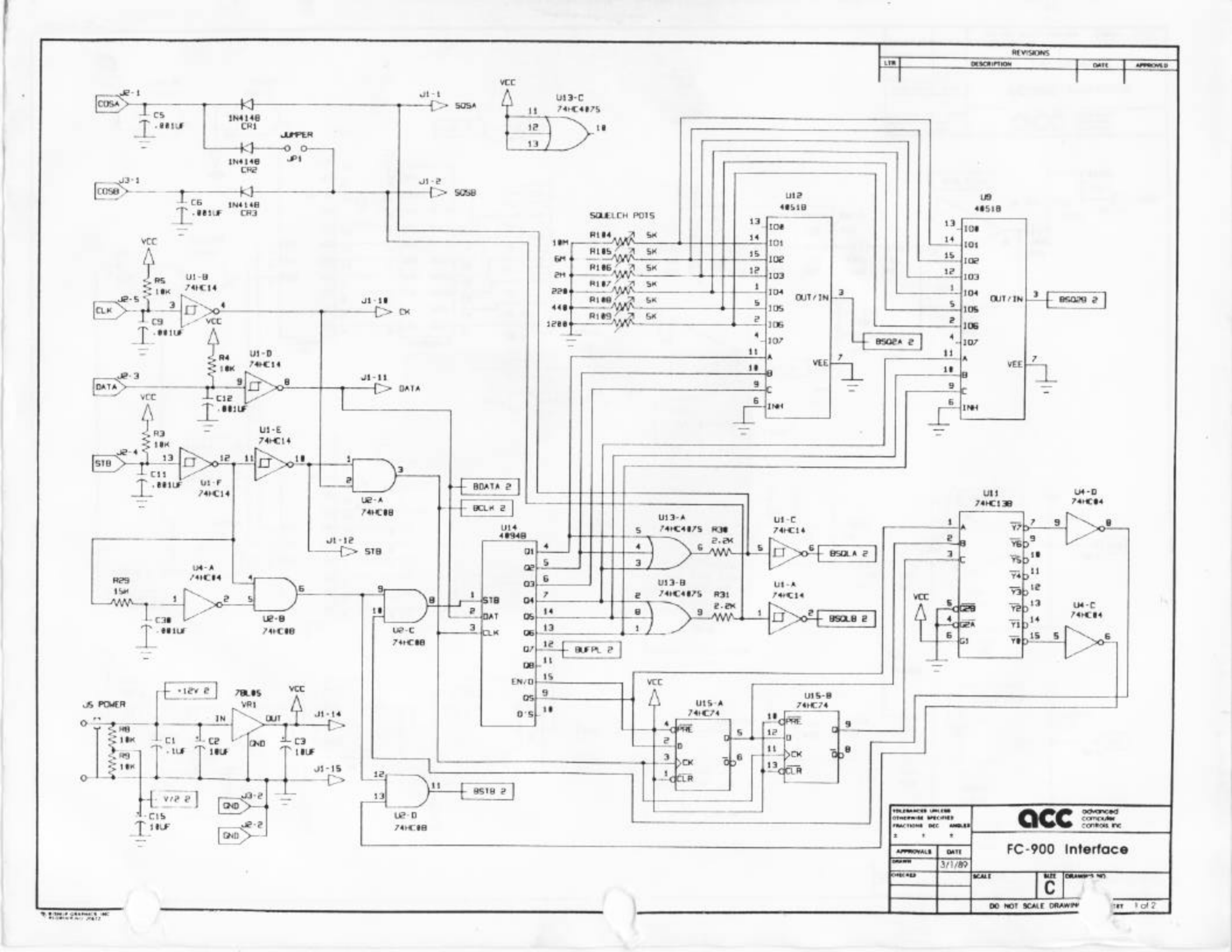
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CR2
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R186
R187
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R189
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U9
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U2-A
74HC08
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U14
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C2
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C3
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FC-900 Interface
SHT 1 of 2