TOA IC-100
Institutional Intercom

Remote Control and Monitoring
Programmer's Guide

Overview

IC-100 security installations often require integration with touch-screen control systems, graphic annunciator panels and camera controllers. TOA offers two options for meeting this requirement:

1. The DI-100 and DI-110 interface products offer a hardware solution—they provide the call LED outputs and select switch inputs required for graphic annunciator panels. They also provide relay outputs for camera switcher integration. Using this off-the-shelf method requires no knowledge of computer programming or serial communication.

2. Integrators using a microprocessor-based product (usually a PC or PLC) as their integrated system's control center, often prefer direct control and monitoring of IC-100 control station activity through the IC-100's integral serial port. Using Remote Control and Monitoring eliminates the need for installing DI-100s and DI-110s and elevates the programmer's level of control.

This document targets programmers who need an understanding of how they can remotely control and monitor the IC-100 by communicating through its RS-232 port. The following document sections provide the details:

Connecting to the IC-100

The MU-110 CPU card includes a DB25 connector for serial communications. Its wiring follows the RS-232 standard for Data Terminal Equipment (DTE). If the serial port on your equipment is also wired as DTE (typical for a terminal or PC), connect to the MU-110 using a straight-through serial cable plus a null-modem adapter. If the serial port on your equipment follows the RS-232 standard for Data Communicating Equipment (DCE, typical for modems), you will not need the null-modem adapter.

Jumper J1 on the MU-110 CPU Card sets the IC-100 serial communication baud rate. TOA ships the MU-110 with jumper J1 in position 4, yielding 1200 bps. You may increase the baud rate to 2400 bps by moving jumper J1 to position 3.

Each data byte communicated through the MU-110 serial port contains 8 data bits, no parity and 1 stop bit. The MU-110 does not support flow control.

IC-100 remote control and monitoring features are only available after you purchase and install optional MU-110 firmware. Any TOA Electronics, Inc. authorized IC-100 dealer may purchase the optional firmware as model IC-EPROM v2.xR. Installing IC-EPROM v2.xR firmware disables the "Speech Path Control" IC-SOFT maintenance screen.

Communicating with the IC-100

Message Tables in this Document

This document describes several types of command messages you can use for controlling and monitoring IC-100 activity. You will find a separate document section for each command message type. Each command message section includes a brief explanation, followed by a table detailing the contents of the fields associated with that message type. The ‘Value’ column of these tables displays hexadecimal values with an "H" suffix, and ASCII character values within parenthesis.

Your development tool(s) may not display all of the ASCII characters represented in this document. *True Type* and *Type 1* fonts reserve characters below 20H for control functions such as indicating tabs and page breaks, rather than for printing or display.

Many commercial terminal emulator programs install their own font for displaying “non-printing” control characters. Similarly, 32-bit versions of Windows ship with a special font, aptly named “Terminal”, which displays all of the ASCII characters represented in this document. While Windows’ HyperTerminal and MS Excel support the Windows Terminal font, few other programs do, as it is neither a *True Type* nor a *Type 1* font.

Message Packaging

All MU-110 serial port messages are packaged using the following format:

<STX><COMMAND><DATA><CHECKSUM><ETX>

The second (<COMMAND>) byte of each message identifies its purpose as indicated below.

Field Name	Length (Bytes)	Value	Description
Stx	1	02H (☻)	Start of text
Command	1	23H (#)	Acknowledgment
		60H (`)	Remote Dial
		70H (p)	Control Station Display Data Stop Request
		71H (q)	Control Station Display Data Start Request
		72H (r)	Control Station Display Data
Data	123 max.		Message Dependent
Checksum	2		Obtain the CHECKSUM value by finding the sum of all bytes after STX and adding 30H to each of the result's two, least-significant, hexadecimal digits.
Etx	1	03H (♥)	End of text

Acknowledgment

The IC-100 transmits a six-byte acknowledgment each time it receives an error-free message through its serial port.

<STX><COMMAND><RESPONSE><CHECKSUM><ETX>

Field Name	Length (Bytes)	Value	Description
Stx	1	02H (☻)	Start of text
Command	1	23H (#)	Acknowledgment
Response	1	30H (0)	No errors
Checksum	2	35H 33H (53)	23H + 30H = 53H 05H + 30H = 35H (5) 03H + 30H = 33H (3)
Etx	1	03H (♥)	End of text

Using the Remote Dial Command

Using the IC-100 Remote Dial Command, you can remotely perform any action normally taken by IC-100 sub-station or control station users. The command you send to the IC-100 identifies the line number of the station for which you want to dial and the digits you want dialed.

Answer or place control station calls by dialing C/# C/# followed by the station number. The two C/# dial digits reset any existing control station activity before initiating the call.

<STX><COMMAND><LINE><DIAL DIGITS><CHECKSUM><ETX>

Field Name	Length (Bytes)	Value	Description
Stx	1	02H (␂)	Start of text
Command	1	60H (`)	Remote Dial
Line	2		Obtain the LINE field value by adding 30H to each hexadecimal digit of the station line number. *Examples:* Sub-station 000 [00H] LINE field = 30H 30H (00) Control Station 015 [0FH] LINE field = 30H 3FH (0?)
Dial Digits	121 max.		*Valid Control Station Dial Digits:*
		30H (0)	0
		31H (1)	1
		32H (2)	2
		33H (3)	3
		34H (4)	4
		35H (5)	5
		36H (6)	6
		37H (7)	7
		38H (8)	8
		39H (9)	9
		3BH (;)	*
		3CH (<)	**C/#**
		3DH (=)	Off-hook
		3EH (>)	On-hook
		3FH (?)	PTT Up
		40H (@)	PTT Down
		41H (A)	Display Calls
		42H (B)	Time Function
		43H (C)	Program
		44H (D)	Conference
		45H (E)	Page
		46H (F)	Priority
		47H (G)	Telephone
		48H (H)	All
		49H (I)	Zone
		4AH (J)	Register Switch On
		4BH (K)	Register Switch Off
			Valid Sub-station Dial Digits:
		B2H (▒)	Normal Call
		B3H (|)	Emergency Call
Checksum	2		Obtain the CHECKSUM value by finding the sum of all bytes after STX and adding 30H to each of the result's two least-significant hexadecimal digits.
Etx	1	03H (♥)	End of text

Monitoring Control Station Activity

Using IC-100 remote monitoring, you can request a copy of all information transmitted to the control stations in the exchange to which you are connected. Once the IC-100 accepts your request, it sends you the information control stations use for updating their LCD screens as well as the information DI-100s use for updating DI-110 LED and Relay outputs. IC-100 integrators typically intercept and utilize the information DI-100s use for updating DI-110 LEDs and relays. See Interpreting DI-100 Call LED Data for more information.

Control Station Display Data Start Request

Before receiving control station display data, you must request it.

<STX><COMMAND><CONTROL STATIONS><CHECKSUM><ETX>

Field Name	Length (Bytes)	Value	Description
Stx	1	02H (☻)	Start of text
Command	1	71H (q)	Control Station Display Data Start Request
Control Stations	1 - 8	31H (1)	AS/DI 1 (Line 015)
		32H (2)	AS/DI 2 (Line 031)
		33H (3)	AS/DI 3 (Line 047)
		34H (4)	AS/DI 4 (Line 063)
		35H (5)	AS/DI 5 (Line 079)
		36H (6)	AS/DI 6 (Line 095)
		37H (7)	AS/DI 7 (Line 111)
		38H (8)	AS/DI 8 (Line 127)
Checksum	2		Obtain the CHECKSUM value by finding the sum of all bytes after STX and adding 30H to each of the result's two, least-significant, hexadecimal digits.
Etx	1	03H (♥)	End of text

Control Station Display Data Stop Request

You must stop control station display data transmission before attempting to use IC-SOFT, TOA's programming and maintenance software.

<STX><COMMAND><CHECKSUM><ETX>

Field Name	Length (Bytes)	Value	Description
Stx	1	02H (☻)	Start of text
Command	1	70H (p)	Control Station Display Data Stop Request
Checksum	2	37H 30H (70)	07H + 30H = 37H (7) 00H + 30H = 30H (0)
Etx	1	03H (♥)	End of text

Interpreting DI-100 Call LED Data

The IC-100 embeds DI-100 call LED messages within the control station display data stream. The IC-100 transmits one of these 12 byte messages with each control station call queue change. The table below details their contents. For a complete listing of all control station display data types, see Appendix A Control Station Display Data .

<STX><COMMAND><ADDRESS><TYPE><STATE><STATION NUMBER><CHECKSUM><ETX>

Field Name	Length (Bytes)	Value	Description
Stx	1	02H (☻)	Start of text
Command	1	72H (r)	Control Station Display Data
Address	1	61H (a)	AS/DI 1 (Line 015)
		62H (b)	AS/DI 2 (Line 031)
		63H (c)	AS/DI 3 (Line 047)
		64H (d)	AS/DI 4 (Line 063)
		65H (e)	AS/DI 5 (Line 079)
		66H (f)	AS/DI 6 (Line 095)
		67H (g)	AS/DI 7 (Line 111)
		68H (h)	AS/DI 8 (Line 127)
Type	1	64H (d)	Call LED control information
State	1	30H (0)	Off
		31H (1)	On (conversation start)
		32H (2)	Emergency call-in*
		33H (3)	Normal call-in*
		34H (4)	Unable to complete call*
		35H (5)	Call-in tone timed out*
		36H (6)	Priority call-in*
			**DI-100 call LED control only*
Station Number	4		This field contains four ASCII characters identifying the station number associated with the LED. Two and three digit station numbers appear left justified within this fixed-length, four-byte field.
Checksum	2		Obtain the CHECKSUM value by finding the sum of all bytes after STX and adding 30H to each of the result's two, least-significant, hexadecimal digits.
Etx	1	03H (♥)	End of text

Appendix A - Control Station Display Data

This table details all of the available control station display message types. Notice that byte 4 of each message identifies its type.

Message Type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
DI switch registration (single)	02H	72H	DI Addr	61H	Switch Number				Station Number				Checksum		03H				
DI switch registration (cont)	02H	72H	DI Addr	62H	First Switch Number				First Station Number				Last Switch Number				Checksum		03H
DI call LED control	02H	72H	DI Addr	64H	State	Station Number				Checksum		03H							
DI busy LED control	02H	72H	DI Addr	65H	State	Station Number				Checksum		03H							
DI relay control	02H	72H	DI Addr	67H	State	Station Number				Checksum		03H							
DI switch cancellation (single)	02H	72H	DI Addr	68H	Switch Number				Checksum		03H								
DI switch cancellation (all)	02H	72H	DI Addr	69H	Dummy				Checksum		03H								
DI station digit registration	02H	72H	DI Addr	6AH	Digits	Checksum		03H											
AS LED on	02H	72H	AS Addr	70H	Checksum		03H												
AS LED off	02H	72H	AS Addr	71H	Checksum		03H												
AS time of day data	02H	72H	AS Addr	72H	Mode	Time of Day				Schedule	Checksum		03H						
AS display data	02H	72H	AS Addr	73H	Display Characters												Checksum		03H
AS PV (privacy) on	02H	72H	AS Addr	74H	Checksum		03H												
AS PV (privacy) off	02H	72H	AS Addr	75H	Checksum		03H												
AS flash display data	02H	72H	AS Addr	76H	Flash Display Characters												Checksum		03H
AS Program (BGM) on	02H	72H	AS Addr	77H	Checksum		03H												
AS Program (BGM) off	02H	72H	AS Addr	78H	Checksum		03H												

Field Values

DI Address	
60H	All DIs
61H	DI-1
62H	DI-2
63H	DI-3
64H	DI-4
65H	DI-5
66H	DI-6
67H	DI-7
68H	DI-8

DI Switch and Station Numbers
Left justified ASCII string

DI State	
30H	Off
31H	On (conversation start)
32H	Emergency call-in*
33H	Normal call-in*
34H	Unable to complete call*
35H	Call-in timed out*
36H	Priority call-in*

** DI call LED control only*

DI Digits in Station Number	
32H	2 digits
33H	3 digits
34H	4 digits

AS Address	
87H	All ASs
71H	AS-1
72H	AS-2
73H	AS-3
74H	AS-4
75H	AS-5
76H	AS-6
77H	AS-7
78H	AS-8

AS Time Display Mode	
30H	24 Hour
31H	AM
32H	PM

AS Time of Day
Right justified ASCII string

AS Active Schedule	
41H	Time Schedule "A"
42H	Time Schedule "B"
43H	Time Schedule "C"
44H	Time Schedule "D"
45H	Time Schedule "E"
46H	Time Schedule "F"
47H	Time Schedule "G"
48H	Time Schedule "H"

AS Display Characters
ASCII string

Appendix B – Extended ASCII Character Codes

Binary	Dec	Hex	Char	Binary	Dec	Hex	Char	Binary	Dec	Hex	Char	Binary	Dec	Hex	Char
00000000	0	00H	null	01000000	64	40H	@	10000000	128	80H	Ç	11000000	192	C0H	└
00000001	1	01H	☺	01000001	65	41H	A	10000001	129	81H	ü	11000001	193	C1H	┴
00000010	2	02H	☻	01000010	66	42H	B	10000010	130	82H	é	11000010	194	C2H	┬
00000011	3	03H	♥	01000011	67	43H	C	10000011	131	83H	â	11000011	195	C3H	├
00000100	4	04H	♦	01000100	68	44H	D	10000100	132	84H	ä	11000100	196	C4H	─
00000101	5	05H	♣	01000101	69	45H	E	10000101	133	85H	à	11000101	197	C5H	┼
00000110	6	06H	♠	01000110	70	46H	F	10000110	134	86H	å	11000110	198	C6H	╞
00000111	7	07H	•	01000111	71	47H	G	10000111	135	87H	ç	11000111	199	C7H	╟
00001000	8	08H	◘	01001000	72	48H	H	10001000	136	88H	ê	11001000	200	C8H	╚
00001001	9	09H	○	01001001	73	49H	I	10001001	137	89H	ë	11001001	201	C9H	╔
00001010	10	0AH	◙	01001010	74	4AH	J	10001010	138	8AH	è	11001010	202	CAH	╩
00001011	11	0BH	♂	01001011	75	4BH	K	10001011	139	8BH	ï	11001011	203	CBH	╦
00001100	12	0CH	♀	01001100	76	4CH	L	10001100	140	8CH	î	11001100	204	CCH	╠
00001101	13	0DH	♪	01001101	77	4DH	M	10001101	141	8DH	ì	11001101	205	CDH	═
00001110	14	0EH	♫	01001110	78	4EH	N	10001110	142	8EH	Ä	11001110	206	CEH	╬
00001111	15	0FH	☼	01001111	79	4FH	O	10001111	143	8FH	Å	11001111	207	CFH	╧
00010000	16	10H	►	01010000	80	50H	P	10010000	144	90H	É	11010000	208	D0H	╨
00010001	17	11H	◄	01010001	81	51H	Q	10010001	145	91H	æ	11010001	209	D1H	╤
00010010	18	12H	↕	01010010	82	52H	R	10010010	146	92H	Æ	11010010	210	D2H	╥
00010011	19	13H	‼	01010011	83	53H	S	10010011	147	93H	ô	11010011	211	D3H	╙
00010100	20	14H	¶	01010100	84	54H	T	10010100	148	94H	ö	11010100	212	D4H	╘
00010101	21	15H	§	01010101	85	55H	U	10010101	149	95H	ò	11010101	213	D5H	╒
00010110	22	16H	▬	01010110	86	56H	V	10010110	150	96H	û	11010110	214	D6H	╓
00010111	23	17H	↨	01010111	87	57H	W	10010111	151	97H	ù	11010111	215	D7H	╫
00011000	24	18H	↑	01011000	88	58H	X	10011000	152	98H	ÿ	11011000	216	D8H	╪
00011001	25	19H	↓	01011001	89	59H	Y	10011001	153	99H	Ö	11011001	217	D9H	┘
00011010	26	1AH	→	01011010	90	5AH	Z	10011010	154	9AH	Ü	11011010	218	DAH	┌
00011011	27	1BH	←	01011011	91	5BH	[	10011011	155	9BH	¢	11011011	219	DBH	█
00011100	28	1CH	∟	01011100	92	5CH	\	10011100	156	9CH	£	11011100	220	DCH	▄
00011101	29	1DH	↔	01011101	93	5DH	]	10011101	157	9DH	¥	11011101	221	DDH	▌
00011110	30	1EH	▲	01011110	94	5EH	^	10011110	158	9EH	₧	11011110	222	DEH	▐
00011111	31	1FH	▼	01011111	95	5FH	_	10011111	159	9FH	ƒ	11011111	223	DFH	▀
00100000	32	20H		01100000	96	60H	`	10100000	160	A0H	á	11100000	224	E0H	α
00100001	33	21H	!	01100001	97	61H	a	10100001	161	A1H	í	11100001	225	E1H	ß
00100010	34	22H	"	01100010	98	62H	b	10100010	162	A2H	ó	11100010	226	E2H	Γ
00100011	35	23H	#	01100011	99	63H	c	10100011	163	A3H	ú	11100011	227	E3H	π
00100100	36	24H	$	01100100	100	64H	d	10100100	164	A4H	ñ	11100100	228	E4H	Σ
00100101	37	25H	%	01100101	101	65H	e	10100101	165	A5H	Ñ	11100101	229	E5H	σ
00100110	38	26H	&	01100110	102	66H	f	10100110	166	A6H	ª	11100110	230	E6H	µ
00100111	39	27H	'	01100111	103	67H	g	10100111	167	A7H	º	11100111	231	E7H	τ
00101000	40	28H	(	01101000	104	68H	h	10101000	168	A8H	¿	11101000	232	E8H	Θ
00101001	41	29H	)	01101001	105	69H	i	10101001	169	A9H	⌐	11101001	233	E9H	Θ
00101010	42	2AH	*	01101010	106	6AH	j	10101010	170	AAH	¬	11101010	234	EAH	Ω
00101011	43	2BH	+	01101011	107	6BH	k	10101011	171	ABH	½	11101011	235	EBH	δ
00101100	44	2CH	,	01101100	108	6CH	l	10101100	172	ACH	¼	11101100	236	ECH	∞
00101101	45	2DH	-	01101101	109	6DH	m	10101101	173	ADH	¡	11101101	237	EDH	Φ
00101110	46	2EH	.	01101110	110	6EH	n	10101110	174	AEH	«	11101110	238	EEH	ε
00101111	47	2FH	/	01101111	111	6FH	o	10101111	175	AFH	»	11101111	239	EFH	∩
00110000	48	30H	0	01110000	112	70H	p	10110000	176	B0H	░	11110000	240	F0H	≡
00110001	49	31H	1	01110001	113	71H	q	10110001	177	B1H	▒	11110001	241	F1H	±
00110010	50	32H	2	01110010	114	72H	r	10110010	178	B2H	▓	11110010	242	F2H	≥
00110011	51	33H	3	01110011	115	73H	s	10110011	179	B3H	│	11110011	243	F3H	≤
00110100	52	34H	4	01110100	116	74H	t	10110100	180	B4H	┤	11110100	244	F4H	⌠
00110101	53	35H	5	01110101	117	75H	u	10110101	181	B5H	╡	11110101	245	F5H	⌡
00110110	54	36H	6	01110110	118	76H	v	10110110	182	B6H	╢	11110110	246	F6H	÷
00110111	55	37H	7	01110111	119	77H	w	10110111	183	B7H	╖	11110111	247	F7H	≈
00111000	56	38H	8	01111000	120	78H	x	10111000	184	B8H	╕	11111000	248	F8H	°
00111001	57	39H	9	01111001	121	79H	y	10111001	185	B9H	╣	11111001	249	F9H	∙
00111010	58	3AH	:	01111010	122	7AH	z	10111010	186	BAH	║	11111010	250	FAH	·
00111011	59	3BH	;	01111011	123	7BH	{	10111011	187	BBH	╗	11111011	251	FBH	√
00111100	60	3CH	<	01111100	124	7CH	¦	10111100	188	BCH	╝	11111100	252	FCH	ⁿ
00111101	61	3DH	=	01111101	125	7DH	}	10111101	189	BDH	╜	11111101	253	FDH	²
00111110	62	3EH	>	01111110	126	7EH	~	10111110	190	BEH	╛	11111110	254	FEH	■
00111111	63	3FH	?	01111111	127	7FH	⌂	10111111	191	BFH	┐	11111111	255	FFG	