INSTALLATION AND OPERATING INSTRUCTIONS

MDC-4RF & MDC-8RF Digital Slave Communicator

OPTEX
1845 W. 205th Street,
Torrance, CA 90501-1510
(800) 966-7839

FEATURES

- 4 or 8 channel slave communicator
- RF operation
- Digital operation
- RF & Digital operation
- 4 digit account number & 2 digit alarm code
- Low voltage report & restore
- Test timer
- EEPROM programmable
- Line seizure and dial tone detection

INTRODUCTION

All major features of the MDC-4RF and MDC-8RF are field programmable to fit the needs of most systems. Memory is EEPROM for fast, easy programming with the MDC-SP programmer.

These units can be used with most control panels. The channel inputs are flexible enough to adapt to almost any alarm indication from ground to 20 volts DC.

Special care has been taken to minimize the effects of RFI, static and lightning on these units.

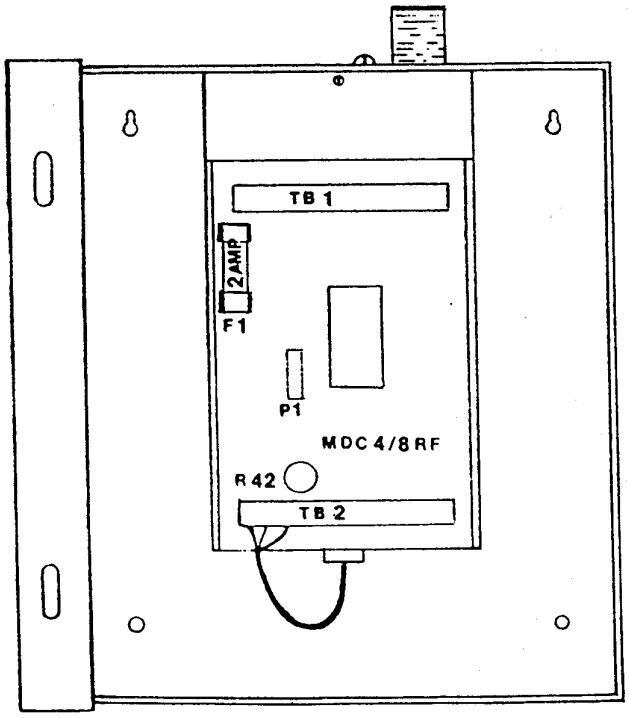


Fig. 1
MDC-4RF & MDC-8RF

COMPONENT DESCRIPTION

F1 - Fuse DC Power 2 amp

P1 - Programmer Jack

TB1 - Channel trip inputs power inputs

TB2 - Radio outputs & telephone line connections

R42 - Modulation Control

Cabinet Size:
Outside: 8-3/8 x 7-3/8 x 3-5/8
Inside: 8-3/16 x 7-1/16 x 3-1/2

The MDC-4RF & MDC-8RF are high value RF/Digital slaves. With design flexibility and versatility in mind. RF and digital operation into the V-300 using either 3/1 Varitech or 4/2 Varitech format. Since this unit is designed for RF and Digital, only the Varitech format can be transmitted providing 255 individual codes.

To minimize RF clashes in large RF systems the following features have been added:

1) Sequence of operation - RF first or Digital first
   RF only or Digital only

2) Number of attempts is programmable on digital and RF. This allows more attempts for units on the fringe of an RF system. Also in systems known to be prone to phone line trouble more attempts may be warranted.

3) Random time delay between transmissions. On RF only this eliminates repeated RF clashes from two subscribers.

4) Self test can be programmed from 1 to 255 hours. This allows long spacing on test timers if desired.

Open/Close signals may be sent from the MDC-4RF/8RF by programming any channel with the Close code in the alarm location and the Open code in the restore location. Since the MDC-4RF/8RF is a slave all channels are 24 hour and may be used for almost any function.

SPECIFICATIONS

Voltage	13.6 DC (12 to 14 power supply)
Current Standby	105 ma.
Current Transmit RF	600 to 700 ma.
Current Digital Communicator	170 ma.
Voltage Range for Trip	3.5 VDC to 20 DC
Low Voltage Trip	11.3 V DC
Low Voltage Restore	12.4 V DC

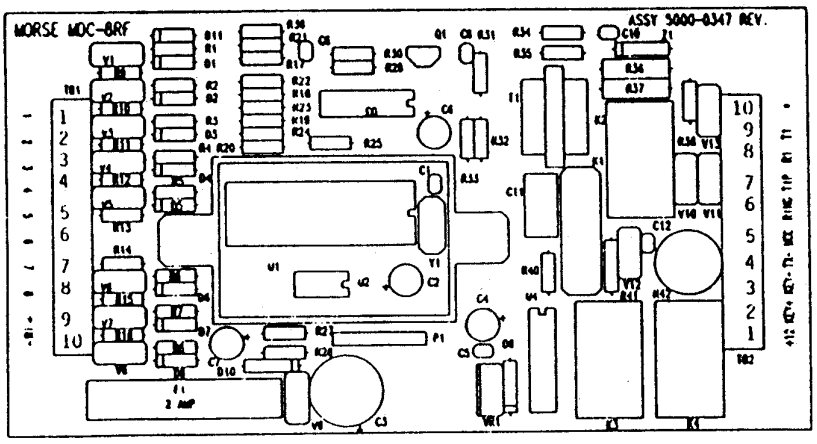


Fig. 2

INSTALLATION

The MDC-4RF/8RF units are designed to be mounted in almost any manner. However, the main concern should be given to antenna location. Since the antenna is most critical in an RF system the following points should be considered:

1 - Height of antenna

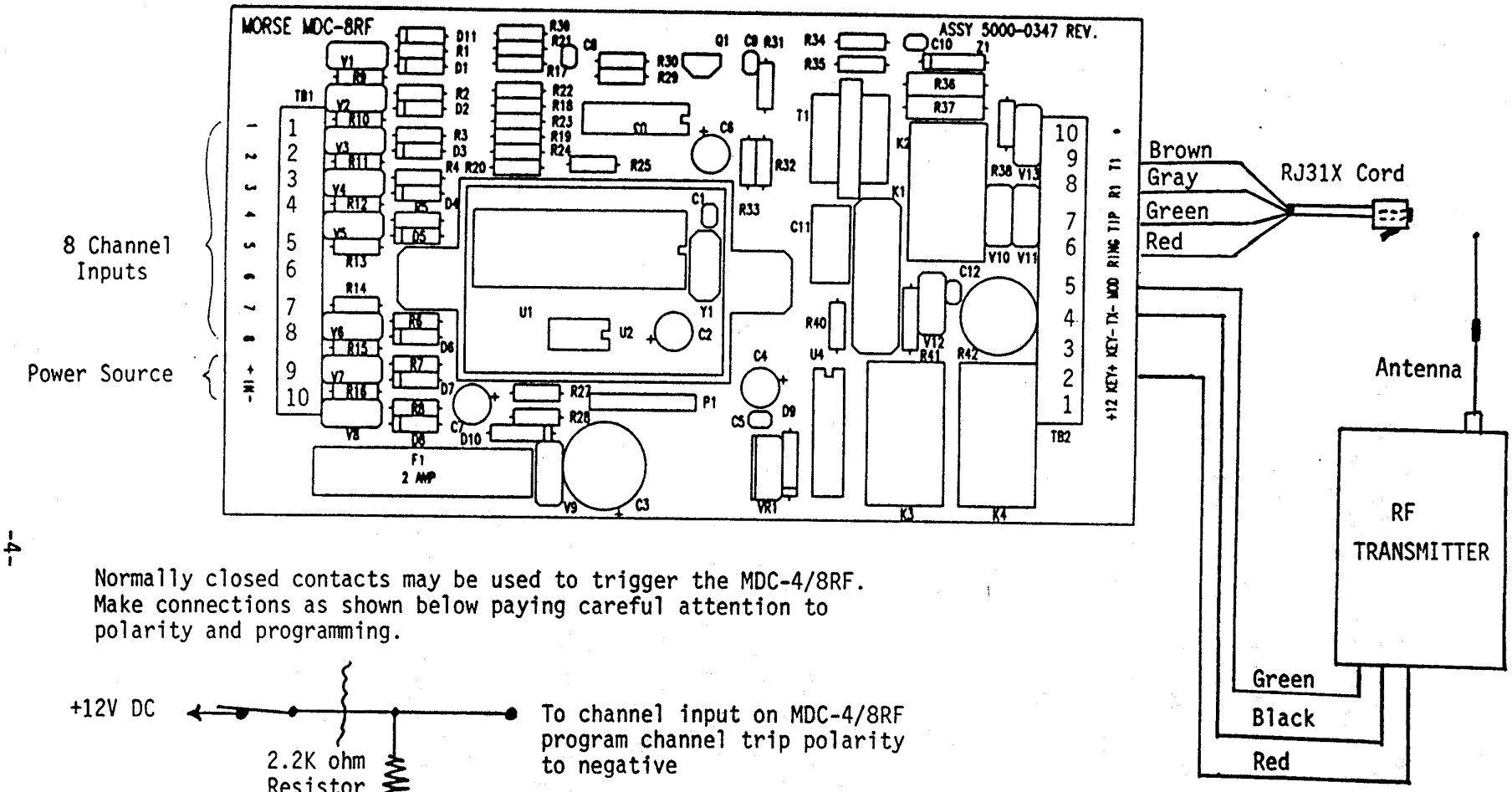
2 - Type of building construction

3 - Room for antenna to extend vertical with no obstructions

4 - Antenna must point up, not to the side

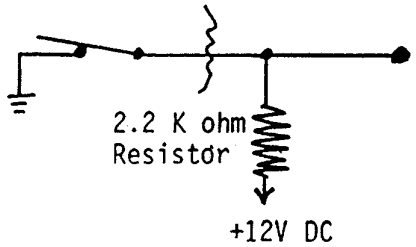
After a mounting location has been selected connect the MDC-4RF/8RF to the control using the following chart and drawing (Fig. 3).

TERMINAL BOARD & PIN NUMBER	DESCRIPTION & PURPOSE	SUGGESTED CONNECTION ON CONTROL
TB1 # 1-8	Channel 1 thru 8 inputs may be programmed negative or positive going on alarm	Bell output Dry relay contact Individual zone output
TB1 # 9 TB1 # 10	12V DC power input DC only 900 ma. -12V DC power input	Auxiliary power Output terminals Separate power supply
TB2 # 1	+12V continuous output future use	----------
TB2 # 2	+12V to key RF transmitter to red on RF transmitter	----------
TB2 # 3	-12V to key RF transmitter future use	----------
TB2 # 4	-12V for RF transmitter to black on RF transmitter	----------
TB2 # 5	Audio to RF transmitter to green on RF transmitter	----------
TB2 # 6 TB2 # 7	Ring Incoming Phone Line Tip	----------
TB2 # 8 TB2 # 9	Ring 1 Home Phone Tip 1	----------
TB2 # 10	Future Use	----------



Normally closed contacts may be used to trigger the MDC-4/8RF. Make connections as shown below paying careful attention to polarity and programming.

To channel input on MDC-4/8RF program channel trip polarity to negative



To channel input on MDC-4/8RF program channel trip polarity to positive

3400-0113

RF INSTALLATION NOTES:

1. The modulation control is set at the factory and should only be adjusted using proper calibrated test equipment. If this is necessary the maximum modulation level is 4KC, 3.5 KC is the factory set point. Power output is 2 watts at 12V DC measured with an RF watt meter into a 50 ohm dummy load. Also there are no user serviceable parts inside the RF transmitter unit. Serious damage and voided warranty may result if the transmitter case is removed.

2. For proper operation of any RF system periodic frequency checks should be made. This test requires a frequency counter or service monitor and is a very simple test. Equipment operating in the 450-470 band must be within ± .0005% of center frequency; for example:

   Center frequency of 460.000 MHz must be within 460.0023 MHz and 459.9977 MHz.

   NOTE: Before attempting to adjust transmitter frequency call Morse Security Group for assistance.

3. Antenna mounting and matching is most important and here are some tips:

   > Read and understand cutting chart supplied with each antenna.

   > Never mount next to an all metal surface - as this deforms the normal signal pattern.

   > Never try to cut antenna rod to a wattmeter or field strength meter.

   > If a high gain remote antenna is used keep cable as short as possible. At 450 MHz frequencies a loss of .5 watts will occur with only 25 feet of RG8 cable.

   > All antennas used in telemetry are vertically polarized and must have elements up and down, not side to side.

4. If a prospective radio site seems to have trouble getting a usable signal to the receiver try another location on site before going to a gain remote antenna. Quite often all possible improvement will be lost in antenna cable.

RF TESTS - ALL MORSE RF EQUIPMENT

Power output, frequency and modulation are set prior to shipment. Should it be necessary to check or adjust the following test equipment is needed:

1) RF Power wattmeter - Bird 43 or equivalent
2) Modulation monitor - Boonton 82AD or equivalent
3) Frequency counter - Digimax D500 or equivalent
4) Service Monitor (replaces 2 & 3) - CT Systems 3000B or equivalent

The above equipment will be most helpful in servicing RF systems after installation.

HOW TO MEASURE POWER OUTPUT ON ANY MORSE RF UNIT:

A. Remove antenna.

B. Connect cable from Bird or equivalent watt meter with a dummy load attached to antenna connector on unit under test.

C. Force the unit to transmit a signal to observe power. On the MDC-4RF or or MDC-8RF jumper TB2 terminal 2 to +12V DC.

D. Observe power - should be from 1.8 to 2 watts.

HOW TO MEASURE FREQUENCY OF ANY MORSE RF UNIT:

E. Set up frequency counter Digimax or equivalent.

F. Force the unit to transmit a signal (same as "C") to check frequency.

G. Read the operating frequency on the counter. This should read in MHz 450.000 to 470.000 (example: 457.5250 MHz).

HOW TO CHECK THE LEVEL OF MODULATION ON ANY MORSE RF UNIT:

H. Set up modulation monitor Boonton or equivalent.

I. Force the unit to transmit an alarm signal to measure modulation by tripping any channel (same as "C").

J. Observe modulation level on modulation monitor. Should be 3.5 to 4 KC of modulation. If adjustment is required repeat step 2 several times and adjust R42 on MDC-4RF or 8RF to no more than 4 KC of modulation. Over modulation will cause the signal to distort and misdecode.

PROGRAMMING

Each memory location has a 2 digit entry, using digits from 0 - F hexidecimal. Most memory locations apply to only one feature, however in some cases a feature conversion table is used. This is done to provide more programmable features with the limited memory space.

Programming is accomplished with the MDC-SP EEPROM programmer. For operation of the MDC-SP refer to its instruction manual #3440-0138NC.

EXPLANATION OF ALL MEMORY ADDRESS LOCATIONS:

LOCATION	DESCRIPTION
0 0	Number of attempts RF and Digital
0 1	Type of transmission (RF and/or Digital) Order of transmission Test timer ON/OFF Low voltage report ON/OFF Pulse or tone dial
0 2	Account Number - last 2 digits
0 3	Account Number - first 2 digits
0 4-0 B	Alarm Code for channels 1 - 8
0 C-1 3	Restore Code for channels 1 - 8
1 4	Low voltage report code
1 5	Low voltage restore code
1 6	Test Timer report code
1 7	Test Timer internal 01-FF (See Hex Table)
1 8-1 E	Phone number (14 digits)
1 F	Channel trip polarity (positive or negative going)

ORDERING INFORMATION:

MDC-4RF	RF Slave, 4 Channel	7130-1009
MDC-8RF	RF Slave, 8 Channel	7130-1008
MDC-SP	Programmer	7128-1000
RF-1306	Whip Antenna	7130-1306
RF-1308	Yagi Antenna	7130-1308
V-9695	V-300 RF Line Card	7128-9695
RF-1000	RF Receiver	7130-1000

DECIMAL TO HEXIDECIMAL CONVERSION CHART

DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX
000	00	040	28	080	50	120	78	160	A0	200	C8	240	F0
001	01	041	29	081	51	121	79	161	A1	201	C9	241	F1
002	02	042	2A	082	52	122	7A	162	A2	202	CA	242	F2
003	03	043	2B	083	53	123	7B	163	A3	203	CB	243	F3
004	04	044	2C	084	54	124	7C	164	A4	204	CC	244	F4
005	05	045	2D	085	55	125	7D	165	A5	205	CD	245	F5
006	06	046	2E	086	56	126	7E	166	A6	206	CE	246	F6
007	07	047	2F	087	57	127	7F	167	A7	207	CF	247	F7
008	08	048	30	088	58	128	80	168	A8	208	D0	248	F8
009	09	049	31	089	59	129	81	169	A9	209	D1	249	F9
010	0A	050	32	090	5A	130	82	170	AA	210	D2	250	FA
011	0B	051	33	091	5B	131	83	171	AB	211	D3	251	FB
012	0C	052	34	092	5C	132	84	172	AC	212	D4	252	FC
013	0D	053	35	093	5D	133	85	173	AD	213	D5	253	FD
014	0E	054	36	094	5E	134	86	174	AE	214	D6	254	FE
015	0F	055	37	095	5F	135	87	175	AF	215	D7	255	FF
016	10	056	38	096	60	136	88	176	B0	216	D8		
017	11	057	39	097	61	137	89	177	B1	217	D9		
018	12	058	3A	098	62	138	8A	178	B2	218	DA		
019	13	059	3B	099	63	139	8B	179	B3	219	DB		
020	14	060	3C	100	64	140	8C	180	B4	220	DC		
021	15	061	3D	101	65	141	8D	181	B5	221	DD		
022	16	062	3E	102	66	142	8E	182	B6	222	DE		
023	17	063	3F	103	67	143	8F	183	B7	223	DF		
024	18	064	40	104	68	144	90	184	B8	224	E0		
025	19	065	41	105	69	145	91	185	B9	225	E1		
026	1A	066	42	106	6A	146	92	186	BA	226	E2		
027	1B	067	43	107	6B	147	93	187	BB	227	E3		
028	1C	068	44	108	6C	148	94	188	BC	228	E4		
029	1D	069	45	109	6D	149	95	189	BD	229	E5		
030	1E	070	46	110	6E	150	96	190	BE	230	E6		
031	1F	071	47	111	6F	151	97	191	BF	231	E7		
032	20	072	48	112	70	152	98	192	C0	232	E8		
033	21	073	49	113	71	153	99	193	C1	233	E9		
034	22	074	4A	114	72	154	9A	194	C2	234	EA		
035	23	075	4B	115	73	155	9B	195	C3	235	EB		
036	24	076	4C	116	74	156	9C	196	C4	236	EC		
037	25	077	4D	117	75	157	9D	197	C5	237	ED		
038	26	078	4E	118	76	158	9E	198	C6	238	EE		
039	27	079	4F	119	77	159	9F	199	C7	239	EF		

This Chart converts decimal values from 000 to 255 into 2 digit hexidecimal equivalents. The test timer internal must be programmed using this Chart. Example: Test time period of 1 day is "24 hours", find 24 in the decimal column and read the hexidecimal equivalent - 24 hours = 18; 72 hours = 48.

"SAMPLE"
PROGRAMMING WORK SHEET
FOR MDC-4RF & MDC-8RF

LOCATION	EXPLANATION		ENTRY DIGITS LEFT	RIGHT
0 0	Number of Attempts Enter 0-F (1-15)	Left RF / Right Digital	[5]	[8]
0 1	Feature Selection			
	RF 1st, Digital 2nd	Add 0		
	RF only	Add 1 ---------->		0
	Digital only	Add 2		
	Digital 1st, RF 2nd	Add 3		
	Test Timer Operational	Add 4 ---------->		4
	4-2 Format Operation	Add 8 ---------->		8
	Low Voltage Operational	Add 1 ---------->	1	
	DTMF Operation	Add 2 ---------->		
			add	add
	0 to 9 enter number; for 10 enter A, 11-B; 12-C; 13-D; 14-E; 15-F		[1]	[C]
0 2	Account Number	Left Hundreds / Right Thousands	[2]	[1]
0 3	Account Number	Left Units / Right Tens	[4]	[3]
0 4	Channel 1 Alarm Code		[0]	[1]
0 5	2		[0]	[2]
0 6	3		[0]	[3]
0 7	4 ____		[0]	[4]
0 8	5 |		[0]	[5]
0 9	6 |____	Not used on MDC-4RF	[0]	[6]
0 A	7 |		[0]	[7]
0 B	8 ____|		[0]	[8]
0 C	Channel 1 Restore Code *		[0]	[9]
0 D	2		[0]	[9]
0 E	3		[0]	[9]
0 F	4 ____		[0]	[9]
1 0	5 |		[0]	[9]
1 1	6 |____	Not used on MDC-4RF	[F]	[F]
1 2	7 |		[F]	[F]
1 3	8 ____|		[F]	[F]

* Entry of F F disables Restore.

SAMPLE WORK SHEET

LOCATION	EXPLANATION	ENTRY DIGITS LEFT	RIGHT
1 4	Low Voltage Report Code	[0]	[F]
1 5	Low Voltage Restore Code (F F Disables)	[F]	[9]
1 6	Test Code	[0]	[E]
1 7	Test Timer Interval*	[A]	[8]

*Interval for test timer is programmed in Hex 0 0 - F F
Example: 12 hours is programmed 0 C
24 hours is programmed 1 8
7 days (168 hours) is programmed A 8
(See Hex Conversion Chart)

Locations 1 8 thru 1 E 14 digit phone number

	LEFT	RIGHT		
1 8	Digit 2	Digit 1	[1]	[A]
1 9	Digit 4	Digit 3	[0]	[8]
1 A	Digit 6	Digit 5	[4]	[0]
1 B	Digit 8	Digit 7	[3]	[2]
1 C	Digit 10	Digit 9	[6]	[5]
1 D	Digit 12	Digit 11	[9]	[6]
1 E	Digit 14	Digit 13	[F]	[F]

Digits 1-0; A-3 seconds pause;
B - dial tone detect; F-end of phone number. After complete phone number has been programmed fill remaining locations with "F"s, this prevents misdials.

1 F Channel 1-8 trip polarity

1 Pos. going add 0 Neg. going add 1 ----------> 1
2 Pos. going add 0 Neg. going add 2 ----------> 2
3 Pos. going add 0 Neg. going add 4 ----------> 4
4 Pos. going add 0 Neg. going add 8 ----------> 8
5-8 Not used on MDC-4RF
5 Pos. going add 0 Neg. going add 1 -------> _____
6 Pos. going add 0 Neg. going add 2 -------> _____
7 Pos. going add 0 Neg. going add 4 -------> _____
8 Pos. going add 0 Neg. going add 8 -------> _____

	add	add
0 to 9 Enter Number; for 10 enter A; 11-B; 12-C; 13-D; 14-E; 15-F	[0]	[F]

PROGRAMMING WORK SHEET
FOR MDC-4RF & MDC-8RF

LOCATION	EXPLANATION	ENTRY DIGITS LEFT - RIGHT
0 0	Number of Attempts Enter 0-F (1-15) Left RF Right Digital	[ ] [ ]
0 1	Feature Selection	
	RF 1st, Digital 2nd — Add 0	
	RF only — Add 1 ----------> ____	
	Digital only — Add 2	
	Digital 1st, RF 2nd — Add 3	
	Test Timer Operational — Add 4 ----------> ____	
	4-2 Format Operation — Add 8 ----------> ____	
	Low Voltage Operational — Add 1 ----------> ____	
	DTMF Operation — Add 2 ----------> ____	
	add ↓ add ↓	
	0 to 9 enter number; for 10 enter A, 11-B; 12-C; 13-D; 14-E; 15-F	[ ] [ ]
0 2	Account Number Left Hundreds Right Thousands	[ ] [ ]
0 3	Account Number Left Units Right Tens	[ ] [ ]
0 4	Channel 1 Alarm Code	[ ] [ ]
0 5	2	[ ] [ ]
0 6	3	[ ] [ ]
0 7	4 ____	[ ] [ ]
0 8	5 |	[ ] [ ]
0 9	6 |____ Not used on MDC-4RF	[ ] [ ]
0 A	7 |	[ ] [ ]
0 B	8 ____|	[ ] [ ]
0 C	Channel 1 Restore Code *	[ ] [ ]
0 D	2	[ ] [ ]
0 E	3	[ ] [ ]
0 F	4 ____	[ ] [ ]
1 0	5 |	[ ] [ ]
1 1	6 |____ Not used on MDC-4RF	[ ] [ ]
1 2	7 |	[ ] [ ]
1 3	8 ____|	[ ] [ ]

* Entry of F F disables Restore.

LOCATION	EXPLANATION	ENTRY DIGITS LEFT - RIGHT
1 4	Low Voltage Report Code	[ ] [ ]
1 5	Low Voltage Restore Code (F F Disables)	[ ] [ ]
1 6	Test Code	[ ] [ ]
1 7	Test Timer Interval*	[ ] [ ]

*Interval for test timer is programmed in Hex 0 0 - F F
Example: 12 hours is programmed 0 C
24 hours is programmed 1 8
7 days (168 hours) is programmed A 8
(See Hex Conversion Chart)

Locations 1 8 thru 1 E 14 digit phone number

	LEFT	RIGHT	
1 8	Digit 2	Digit 1	[ ] [ ]
1 9	Digit 4	Digit 3	[ ] [ ]
1 A	Digit 6	Digit 5	[ ] [ ]
1 B	Digit 8	Digit 7	[ ] [ ]
1 C	Digit 10	Digit 9	[ ] [ ]
1 D	Digit 12	Digit 11	[ ] [ ]
1 E	Digit 14	Digit 13	[ ] [ ]

Digits 1-0; A-3 seconds pause;
B - dial tone detect; F-end of phone number. After complete phone number has been programmed fill remaining locations with "F"s, this prevents misdials.

1 F Channel 1-8 trip polarity

1 Pos. going add 0 Neg. going add 1 ----------> _____
2 Pos. going add 0 Neg. going add 2 ----------> _____
3 Pos. going add 0 Neg. going add 4 ----------> _____
4 Pos. going add 0 Neg. going add 8 ----------> _____
5-8 Not used on MDC-4RF
5 Pos. going add 0 Neg. going add 1 -------> _____
6 Pos. going add 0 Neg. going add 2 -------> _____
7 Pos. going add 0 Neg. going add 4 -------> _____
8 Pos. going add 0 Neg. going add 8 -------> _____

add add

0 to 9 Enter Number; for 10 enter A; [ ] [ ]
11-B; 12-C; 13-D; 14-E; 15-F

GLOSSARY

ATTEMPTS	Number of times the same message is sent on RF; number of times the phone number is dialed on a digital communicator.
db	The symbol used for decibel. Decibel is the unit expressing power gains or losses.
DECIMAL	The Base 10 numbering system. See Hexidecimal for example.
DIGITAL	In this document and the alarm industry "digital" refers to the digital communicator.
DRY CONTACT	Refers to a set of relay points that have no power applied. When used the device connected to supplies the power.
DUMMY LOAD	In RF terminology and this document "dummy load" refers to a fixed 50 ohm load. This is used as a fixed reference in place of the antenna. Very useful when testing and not wanting to radiate an RF signal.
EEPROM	Electrically Erasable Programmable Read Only Memory - A memory device that can be erased and programmed many times without removing from the circuit.
FIELD STRENGTH METER	Device used to measure the intensity of the electromagnetic field produced by some transmitting source.
FORMAT 4/2	In the alarm industry and this document "Format 4/2" refers to the number of digits sent in the account number and alarm code, i.e. Account Number 4 digits, Alarm Code 2 digits.
FREQUENCY	The number of cycles per second of a changing wave form.
FREQUENCY BAND	A list of frequencies that appear between two fixed end frequencies.
FREQUENCY COUNTER	A device that measures the cycles per second of a changing wave form. Used to check frequency of an RF transmitter. Also called frequency meter.
FREQUENCY DEVIATION	The maximum shift from the carrier frequency. Usually expressed in KC (Kilo Cycles). Also known as KC of modulation.
FREQUENCY MODULATION FM	The act of impressing information on a carrier signal by changing its frequency at the information rate.
GAIN	The increase in current, voltage or power level in a signal. Usually expressed in decibels (db). In this document "gain" refers to antenna types.
HEXIDECIMAL	The Base 16 numbering system used as the basis for most computer systems. Example: 0 1 2 3 4 5 6 7 8 9 A B C D E F 10 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

KC, KHz KILO CYCLES	1000 cycles used to refer to KC of modulation or frequency deviation.
KC OF MODULATION	See frequency deviation and KC.
MHz "MEGAHERTZ"	One million cycles per second. Sometimes referred to as megacycle.
MEMORY ADDRESS	A code identifying a unique location in a memory array. In this document Memory Location is the same.
MEMORY LOCATION	See Memory Address.
MODULATION	The act of impressing information on a carrier signal by varying the amplitude, phase, frequency or other characteristics.
MODULATION MONITOR	A device to measure the level of modulation. Also called a Modulation Meter.
NEGATIVE GOING TRIP	This describes the non-normal state seen as an alarm condition, i.e. Positive Normal - Negative for Alarm.
POSITIVE GOING TRIP	This describes the non-normal state seen as an alarm condition. i.e. Negative Normal - Positive for Alarm.
RF	The abbreviation for "Radio Frequency". This term is commonly used to refer to any form of electro magnetic transmission in open air.
RF CLASHES	Any time two or more RF transmitter operate at exactly same time and cause one or both not to be received.
RFI	Radio Frequency Interference - any unwanted RF signal.
RJ31X JACK	A modular jack, cord and plug approved for use when direct connecting to a standard dial telephone line. This jack provides connections to give priority to an alarm transmission over normal phone use.
RG 8 CABLE	A 50 ohm coaxial cable used to connect antennas to RF systems. Many types of cable exist for special uses.
SERVICE MONITOR	A device designed to measure all the different parameters in an RF system: power, field strength, frequency, modulation, interference, band pass and more.
SLAVE	In the alarm industry and this document a term used for any communication device that requires other equipment to operate, i.e. slave communicators, slave transmitters, etc.
TRANSMISSION	The act of sending information over a communication link or path using electromagnetic energy.
TRANSMITTER	The device used to generate the electromatic energy to send information over a communication link or path; abbreviation: Tx or Xmtr.

TELEMETRY	Transmitting measurement or condition information from a remote location by wire or RF.
WATT	The unit of electrical and electromagnetic power.
WATT METER	A device used to measure RF power generated in a transmitter and to check the condition of the antenna system.
WHIP ANTENNA	A single vertical element, metal rod or conductor, used in RF systems to radiate or receive electromatic signals. Whip antennas are usually designed for use on vehicles.
YAGI ANTENNA	A multi-element, metal rod or conductor, used in RF systems to radiate or receive electromatic signals. Yagi antennas are designed to provide a directional coverage pattern and a gain factor.