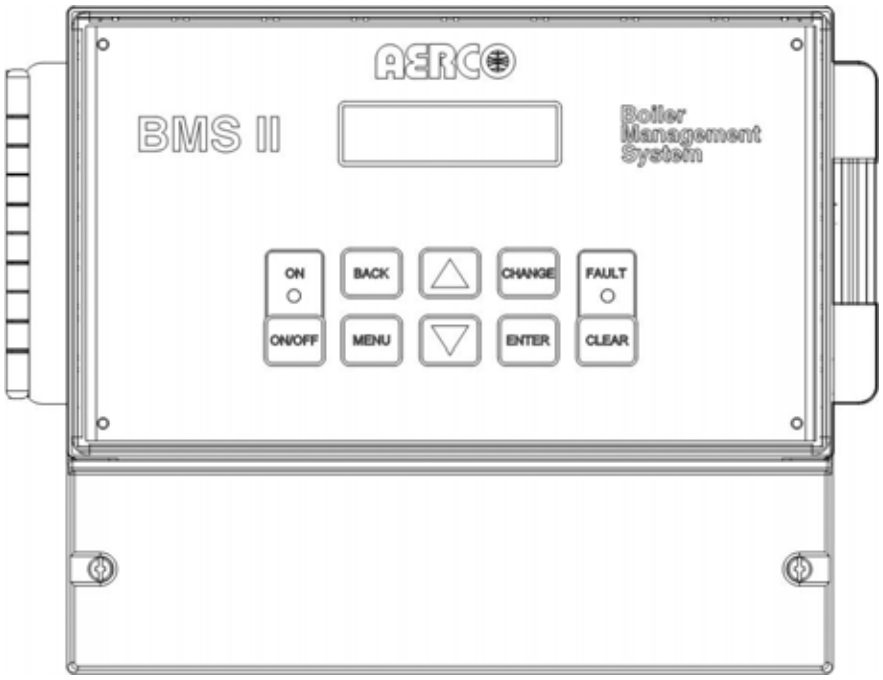
Instruction No. **GF-124**

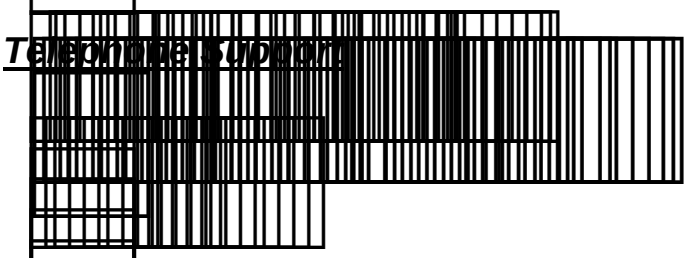
AERCO INTERNATIONAL, Inc., Northvale, New Jersey, 07647 USA

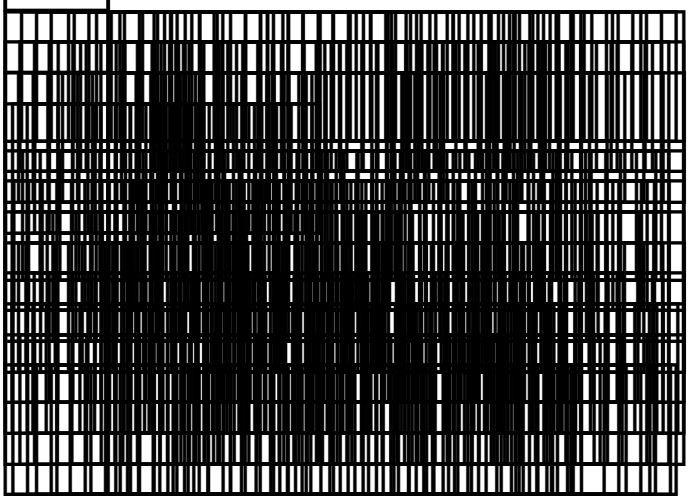
Installation, Operation & Maintenance Instructions

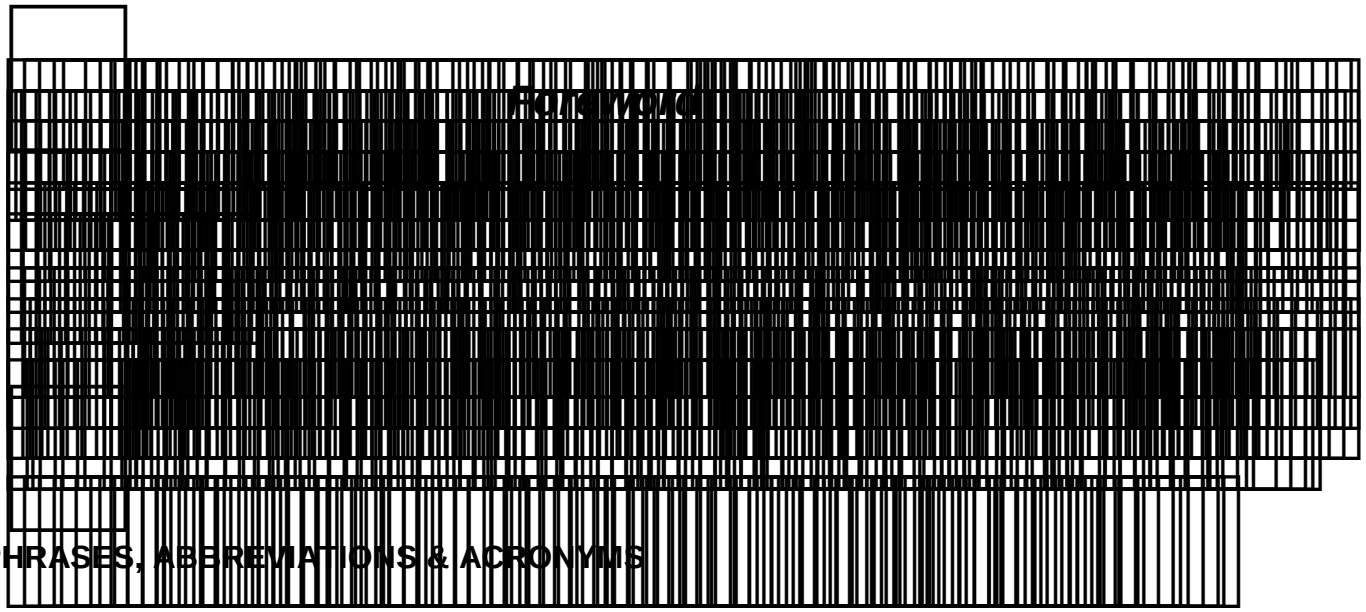
BMS II BOILER MANAGEMENT SYSTEM



JANUARY, 2009







PHRASES, ABBREVIATIONS & ACRONYMS

Phrases, Abbreviations and Acronyms

Phrase, Abbreviation or Acronym	Meaning

FOREWORD

Phrases, Abbreviations and Acronyms - Continued

Phrase, Abbreviation or Acronym	Meaning

GF-124 – BMS II BOILER MANAGEMENT SYSTEM
Operating & Maintenance Instructions

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TABLE OF CONTENTS (cont.)

CHAPTER 1 - GENERAL INFORMATION

1.1 SAFETY PRECAUTIONS & WARNINGS

1.2 INTRODUCTION

1.3 BMS GENERAL DESCRIPTION

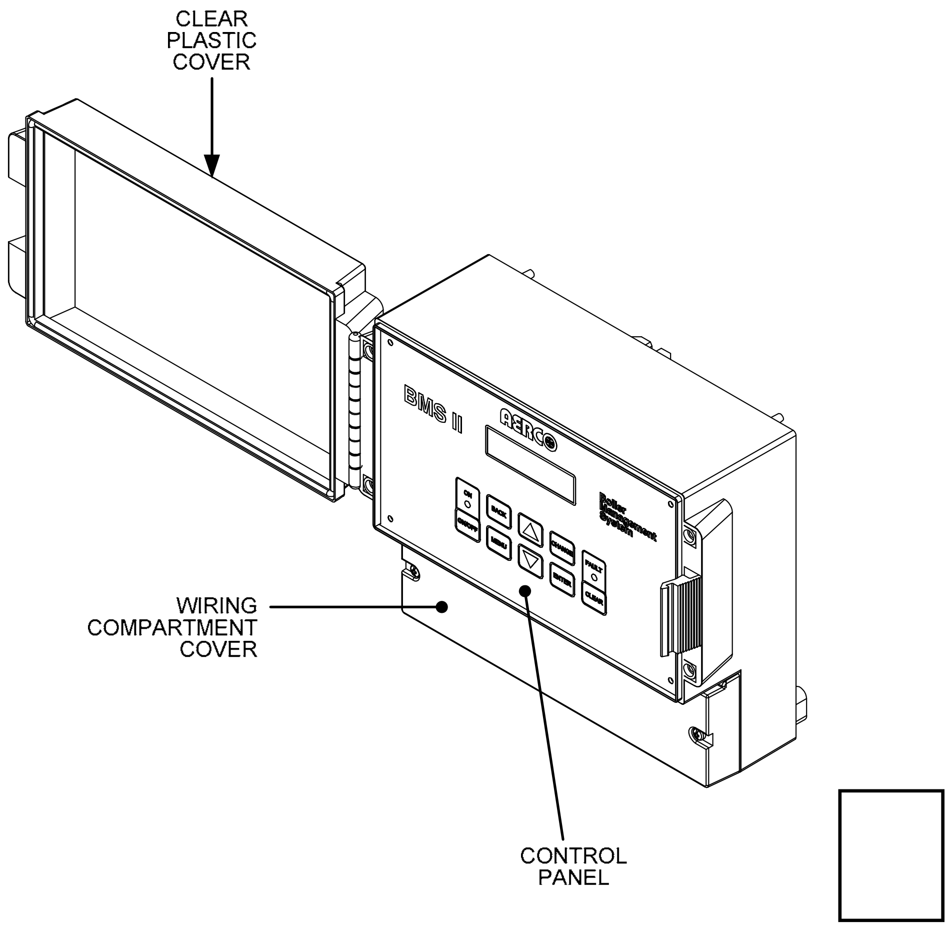
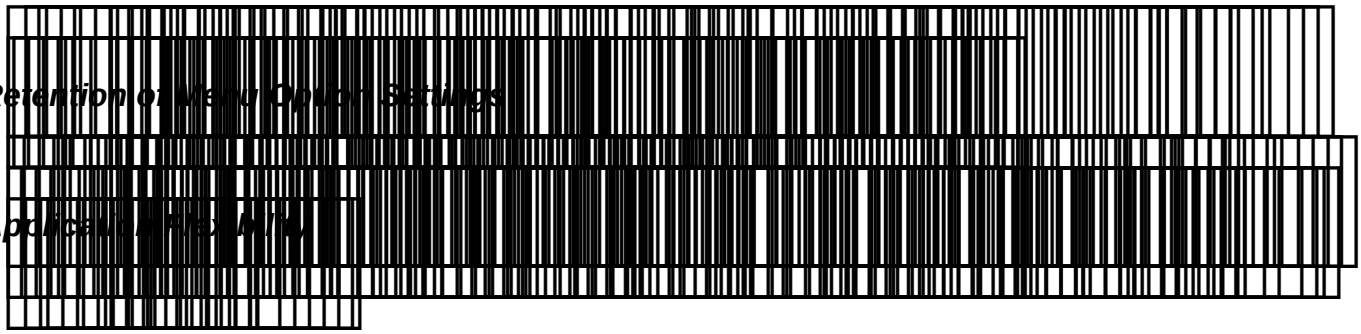


Figure 1-1. Boiler Management System II (BMS)

1.4 BMS II FEATURES

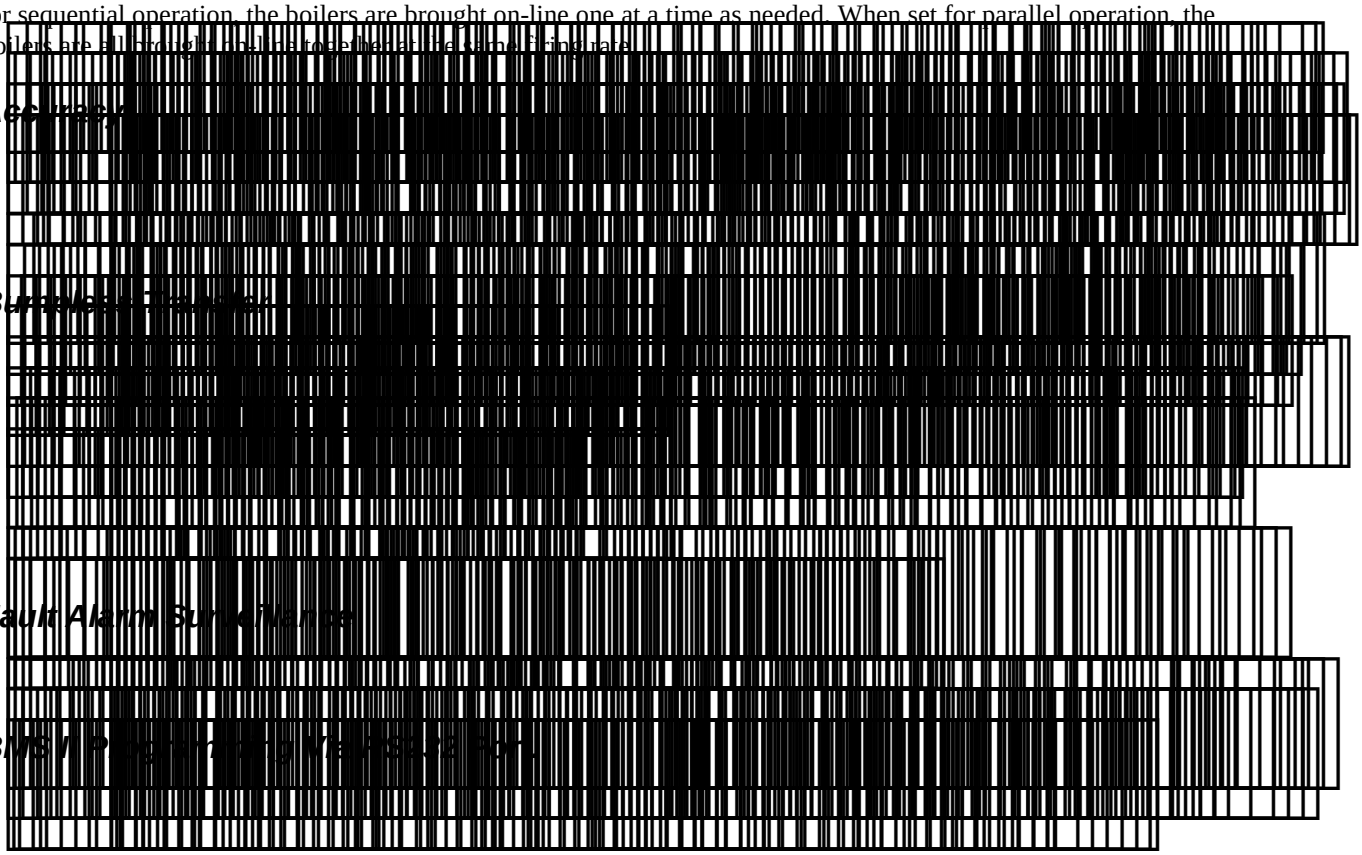
Simplified Installation and Setup

User-Friendly Control System Interface



Sequential or Parallel Operation

Boilers can be programmed for either sequential or parallel operation using the BMS II keypad controls. When set for sequential operation, the boilers are brought on-line one at a time as needed. When set for parallel operation, the boilers are all brought on-line together at the same firing rate.



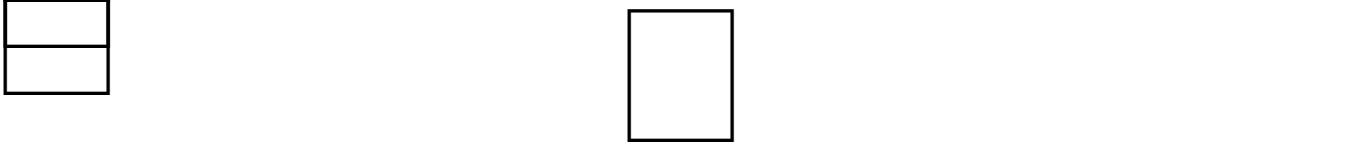
CHAPTER 2 - INSTALLATION

2.1 INTRODUCTION

2.2 SITE SELECTION AND MOUNTING

-
-

Mounting the ETS



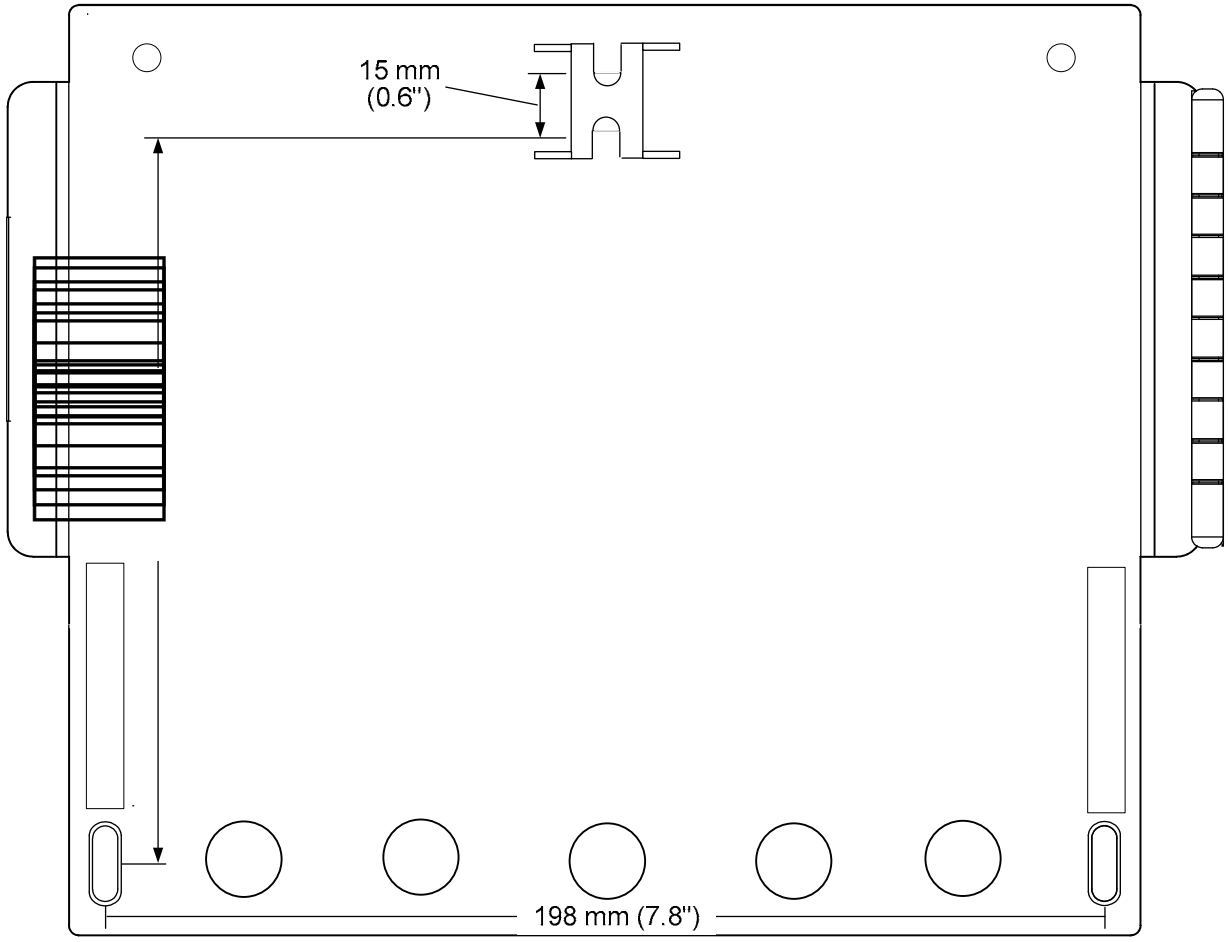


Figure 2-1. BMS II Mounting Provisions

2.3 GENERAL WIRING REQUIREMENTS

NOTE

WARNING

2.4 POWER WIRING

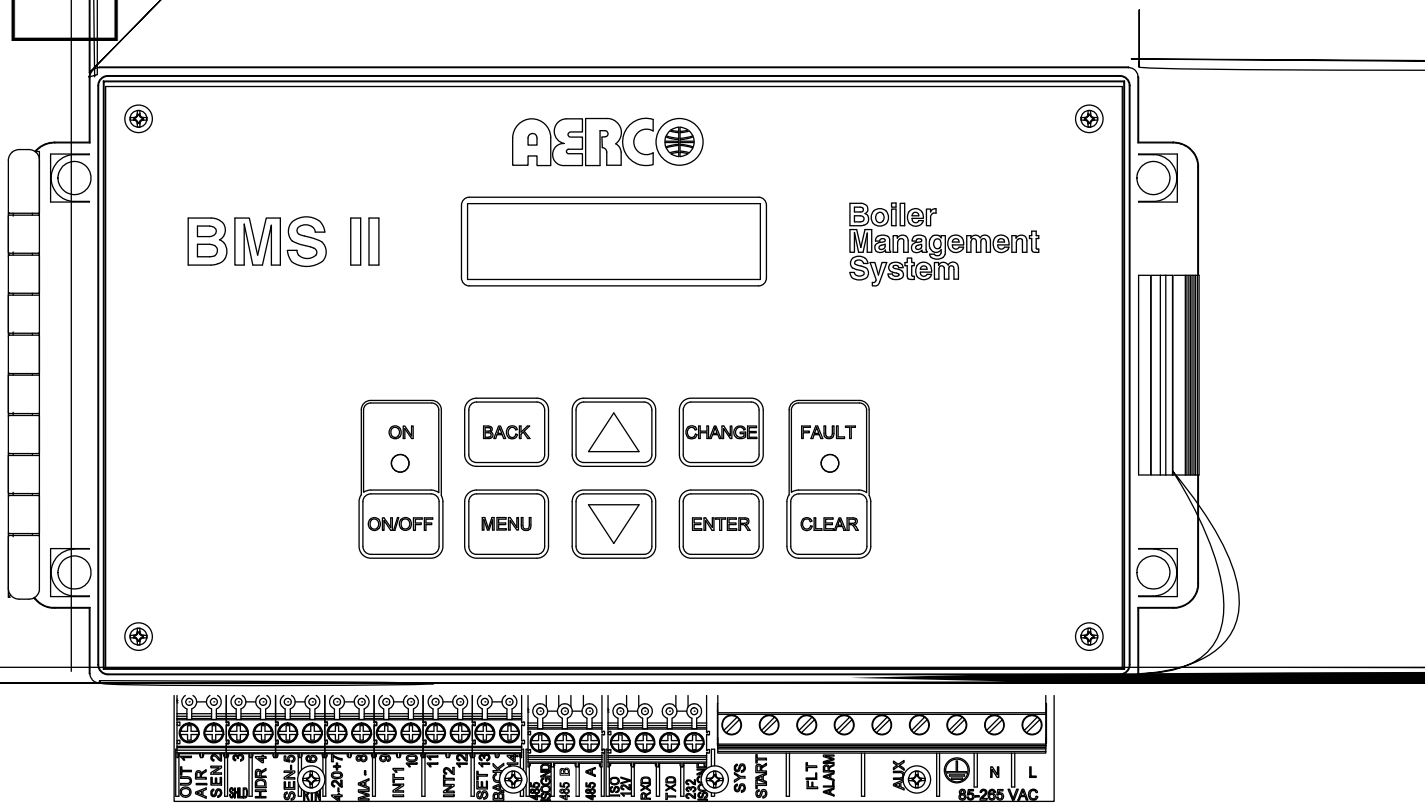
1.

AERCO BMSII
REV XXX

(Where XXX represents the revision level of the installed BMS II software)

HEADER TEMP
SENSOR ERROR

HEADER SENSOR
ERROR


AERCO
BMS II
Boiler
Management
System
ON
ON/OFF
BACK
MENU
CHANGE
ENTER
FAULT
CLEAR

OUT 1
AIR
SEN 2
3
SHD
HDR 4
SEN-5
6
4-20+7
MA - 8
INT1 9
10
11
INT2 12
SET 13
BACK 14
485 GND
485 B
485 A
ISO 12V
RXD
TXD
232 GND
SYS START
FLT ALARM
AUX
N
L
85-265 VAC

2.5

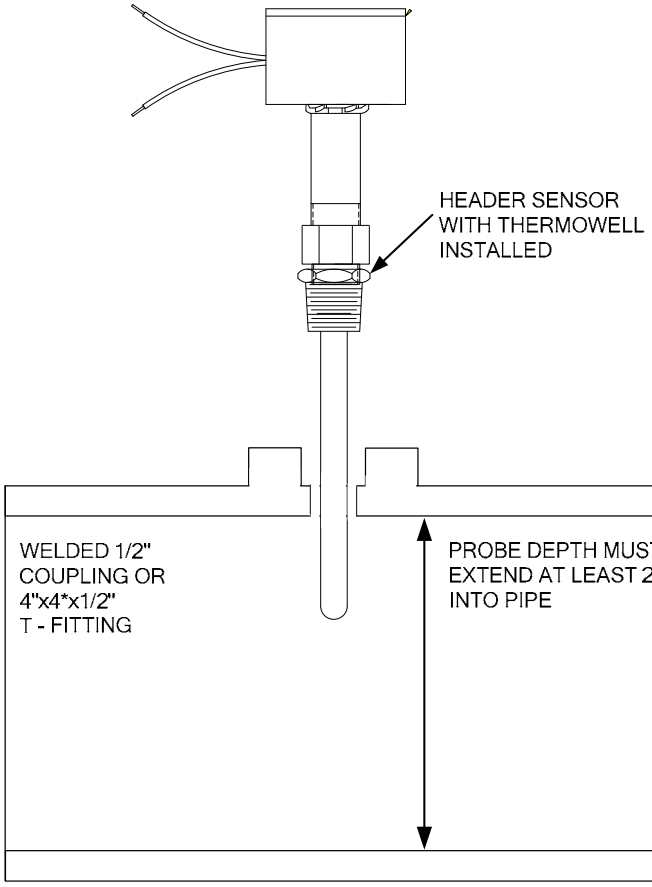


Figure 2-3. Header Sensor Installation Details

Outdoor Sensor

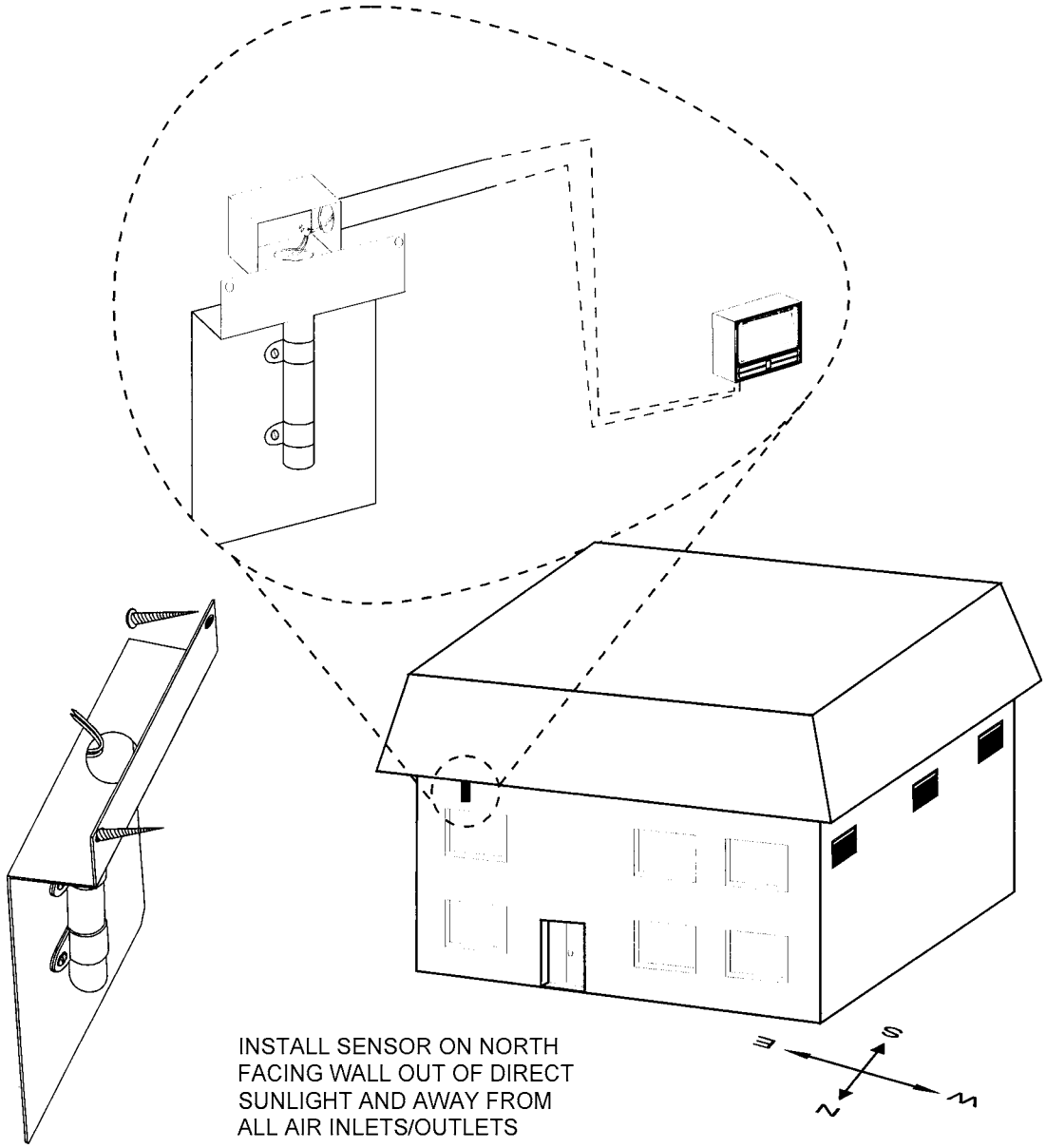


Figure 2-4. Outdoor Air Sensor Installation

2.6 RS485 MODBUS WIRING DIAGRAMS

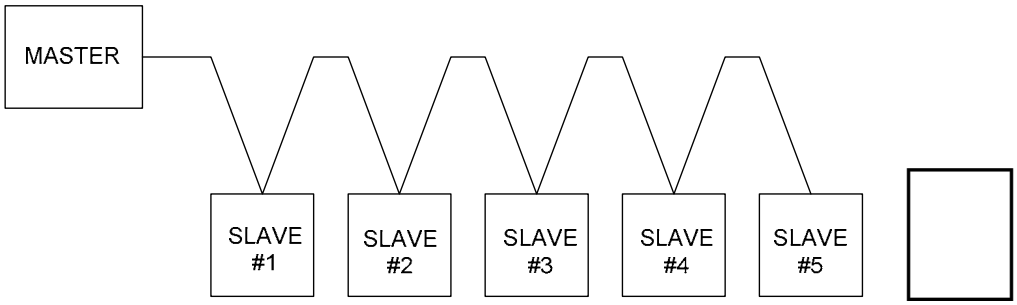
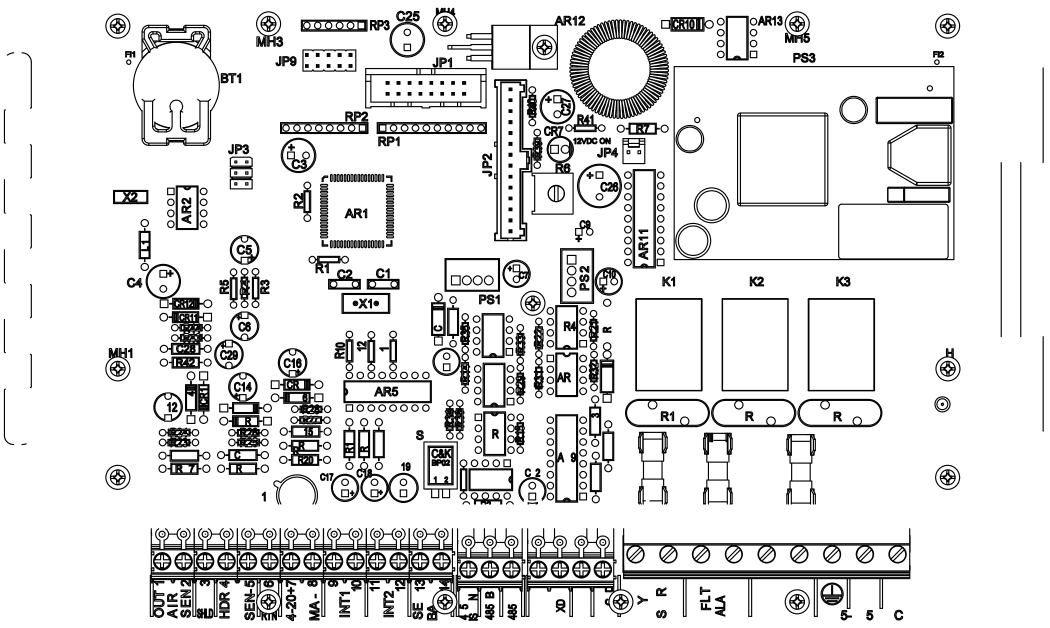


Figure 2-5: Typical daisy-chain Modbus RS485 network

485 B+

485 A-

BMS / Bus Switches


BT1
MH3
RP3
C25
AR12
AR13
PS3
JP9
JP1
RP2
RP1
JP3
C3
JP2
R41
R7
CR7
12VDC ON
JP4
R6
C26
X2
AR2
AR1
R2
L1
C5
R1
C2
C1
X1
R5
R3
C4
PS1
PS2
AR11
K1
K2
K3
C8
MH1
C29
C16
C14
AR5
R10
R4
R1
C&K
OUT 1
AIR
SEN 2
3
SHLD
HDR 4
SEN-5
6
RTN
4-20+7
MA - 8
9
INT1
10
11
INT2
12
SE
13
485 B
485
Y
S
R
FLT
ALA
C

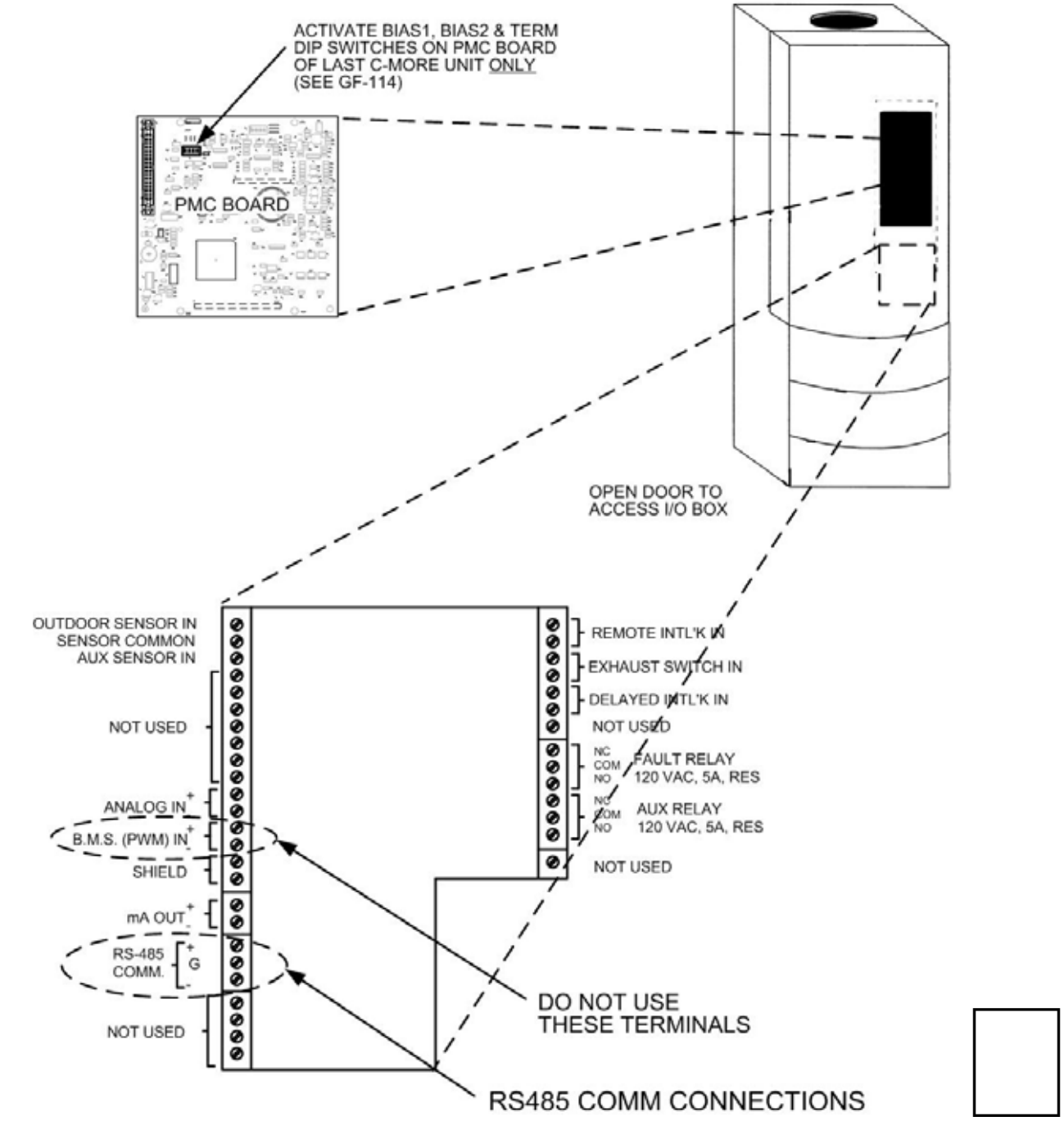


Figure 2-7. RS485 (Modbus) Wiring For Benchmark Series Boilers

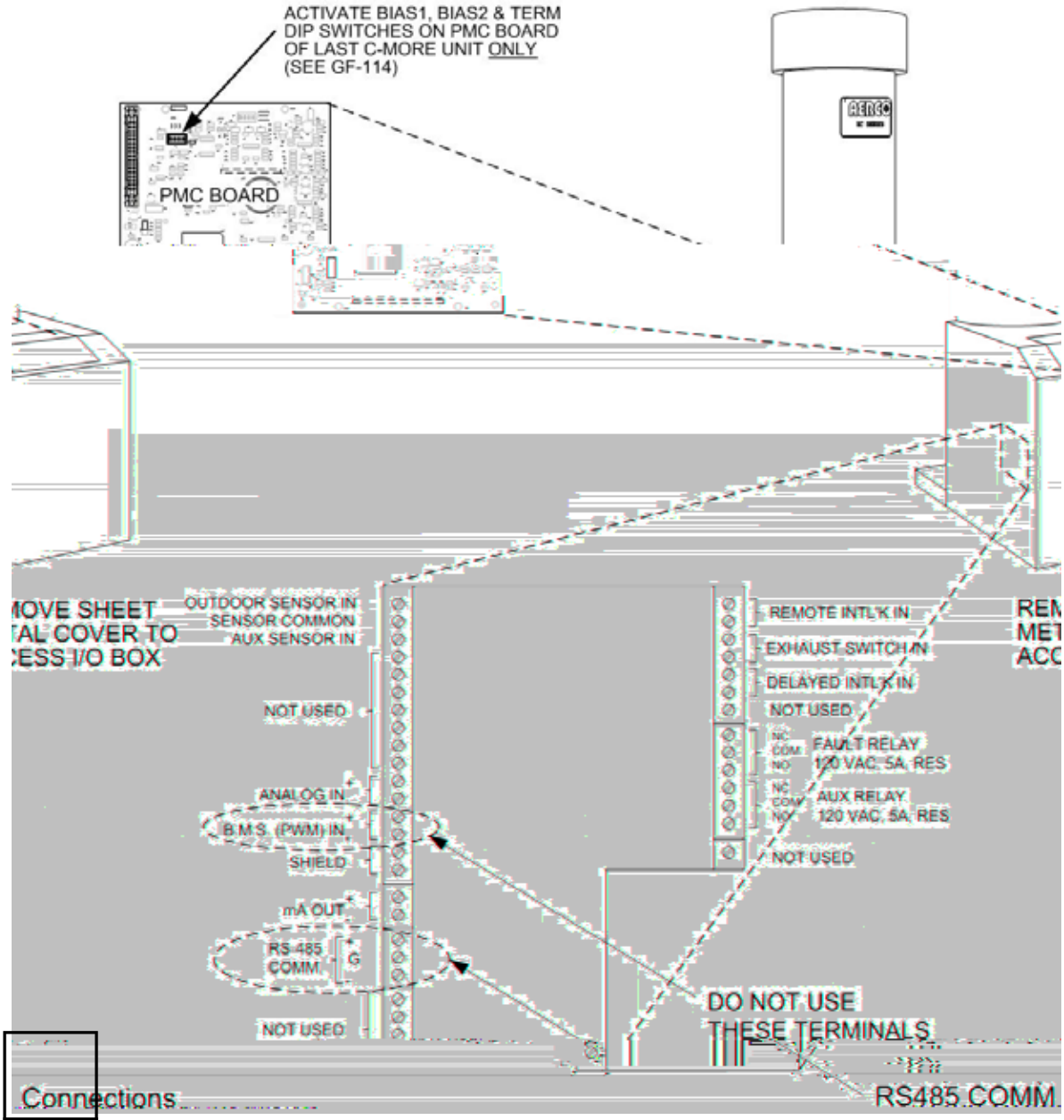
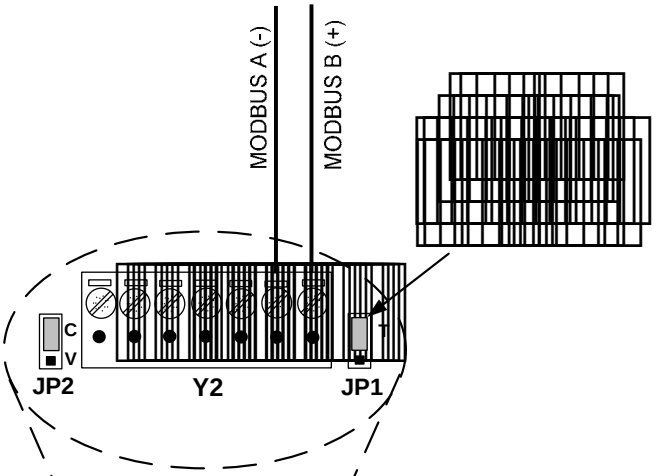


Figure 2-8. RS485 (Modbus) Wiring For KC1000 Boilers



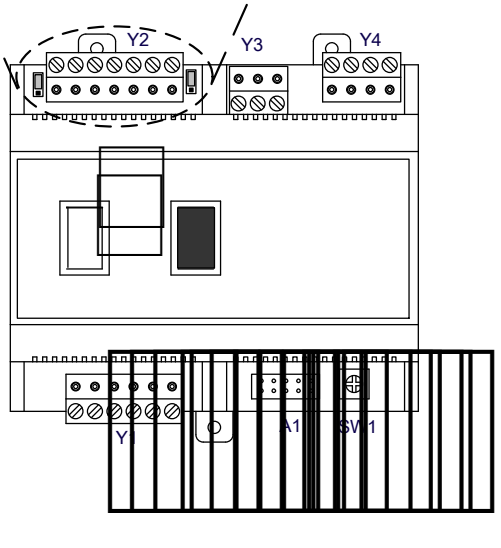


Figure 2-9. RS485 (Modbus) Wiring For Modulex Series Boilers

2.8 SAMPLE RESPONSES TO NETWORK OPERATIONS

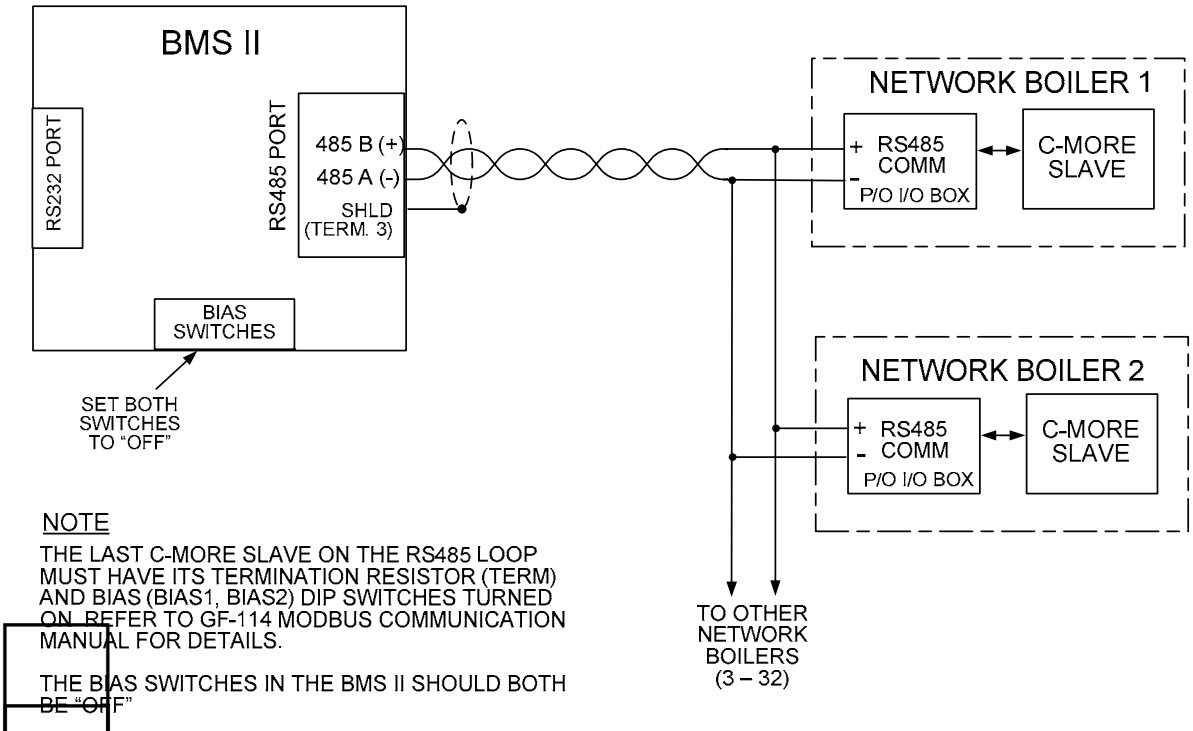


Figure 2-10. Sample RS485 (Modbus) Network For Benchmark or KC1000 Boilers

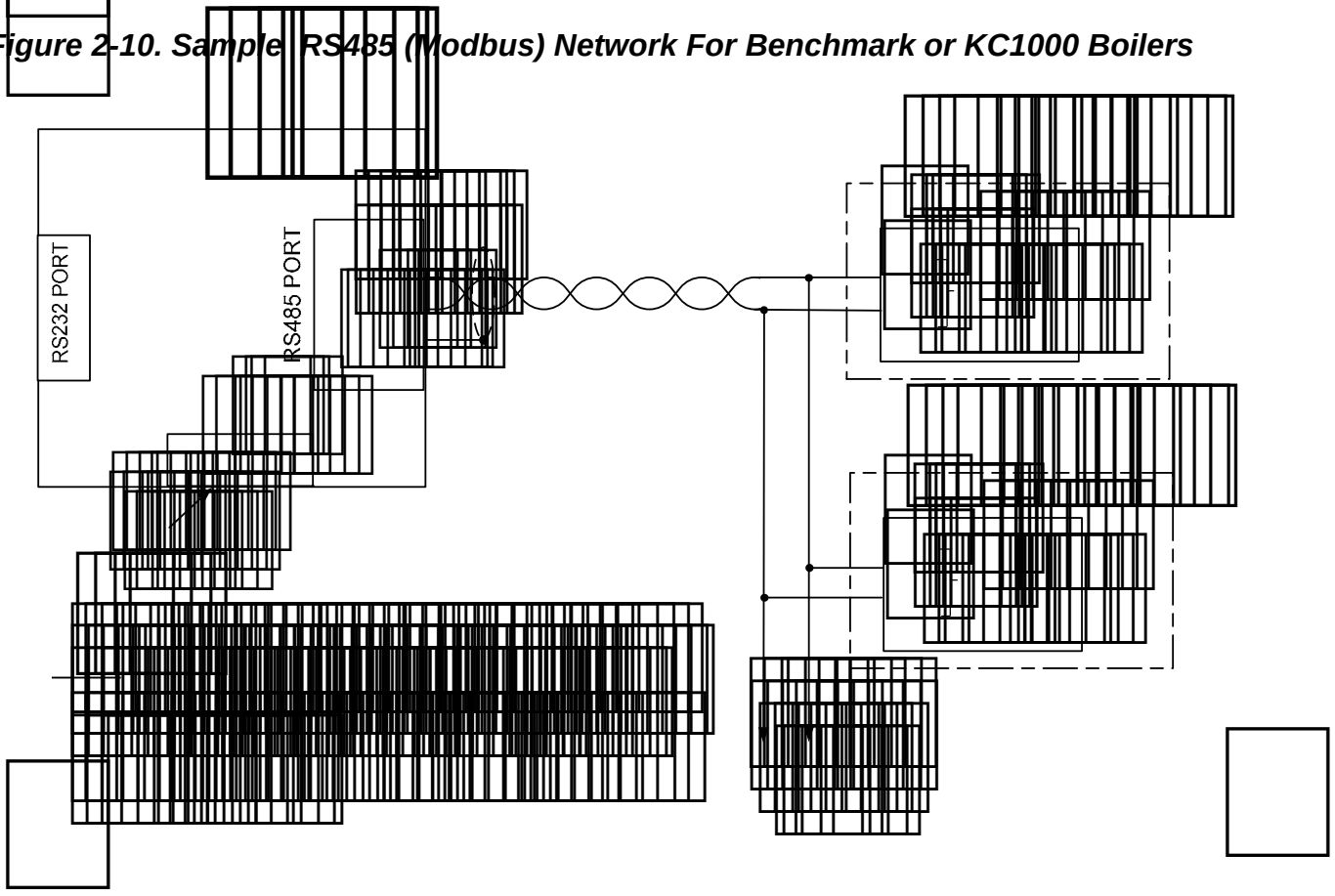


Figure 2-11. Sample RS485 (Modbus) Network For Modulex Series Boilers

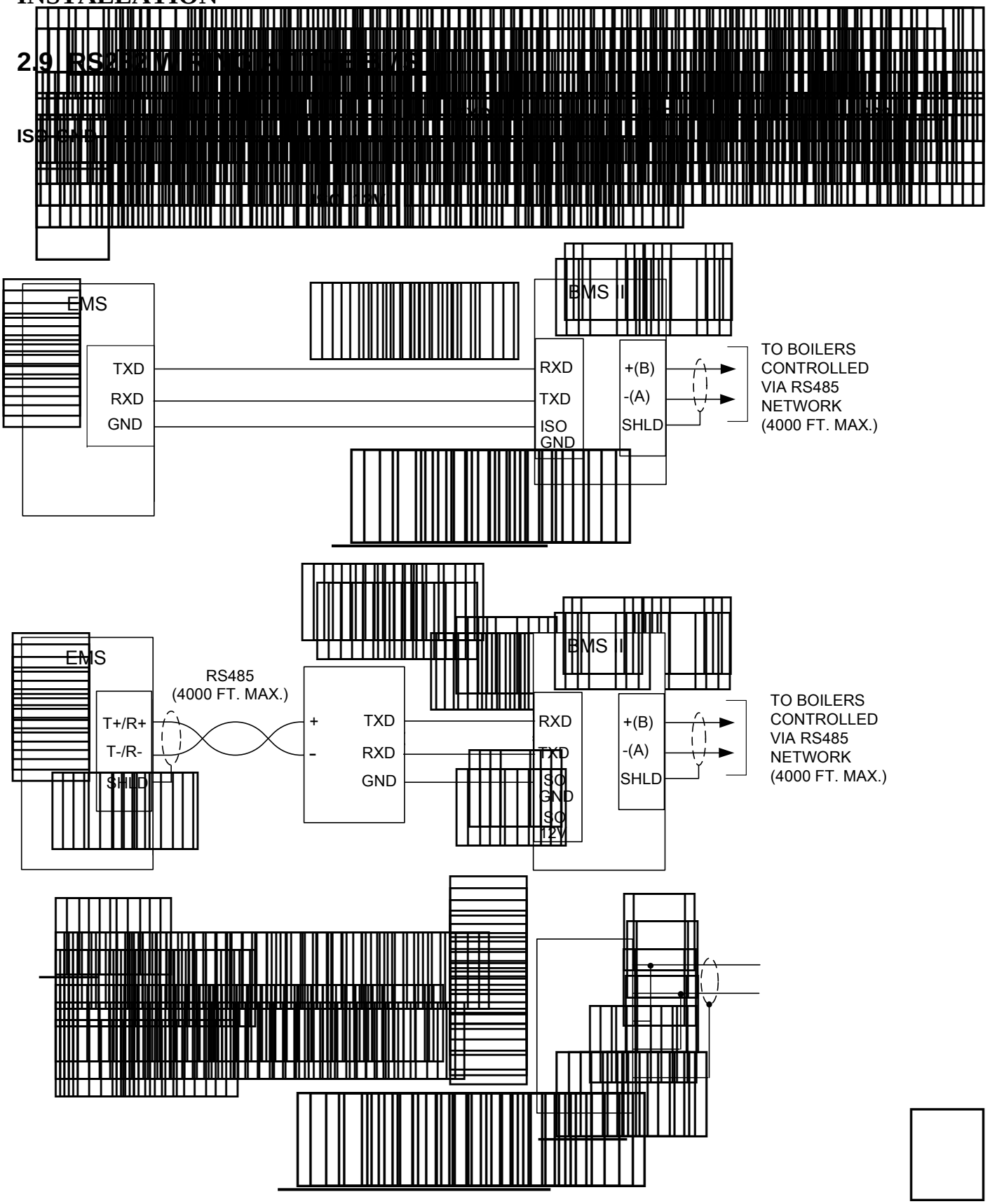


Figure 2-12. Sample Network Connections To EMS

2.10 INTERLOCK WIRING

Interlock Wiring (Wet)

Interlock Wiring (Dry)

2.11 SETBACK WIRING

SETBACK

BACK

2.12 REMOTE

[redacted]

[redacted]

System Start Fault Alarm Relay

[redacted]

Fault Alarm Relay

[redacted]

Auxiliary Relay

[redacted]

2.13 [redacted]

[redacted]

CHAPTER 3 - OPERATION

3.1 INTRODUCTION

3.2 FRONT PANEL OPERATING CONTROLS AND DISPLAYS

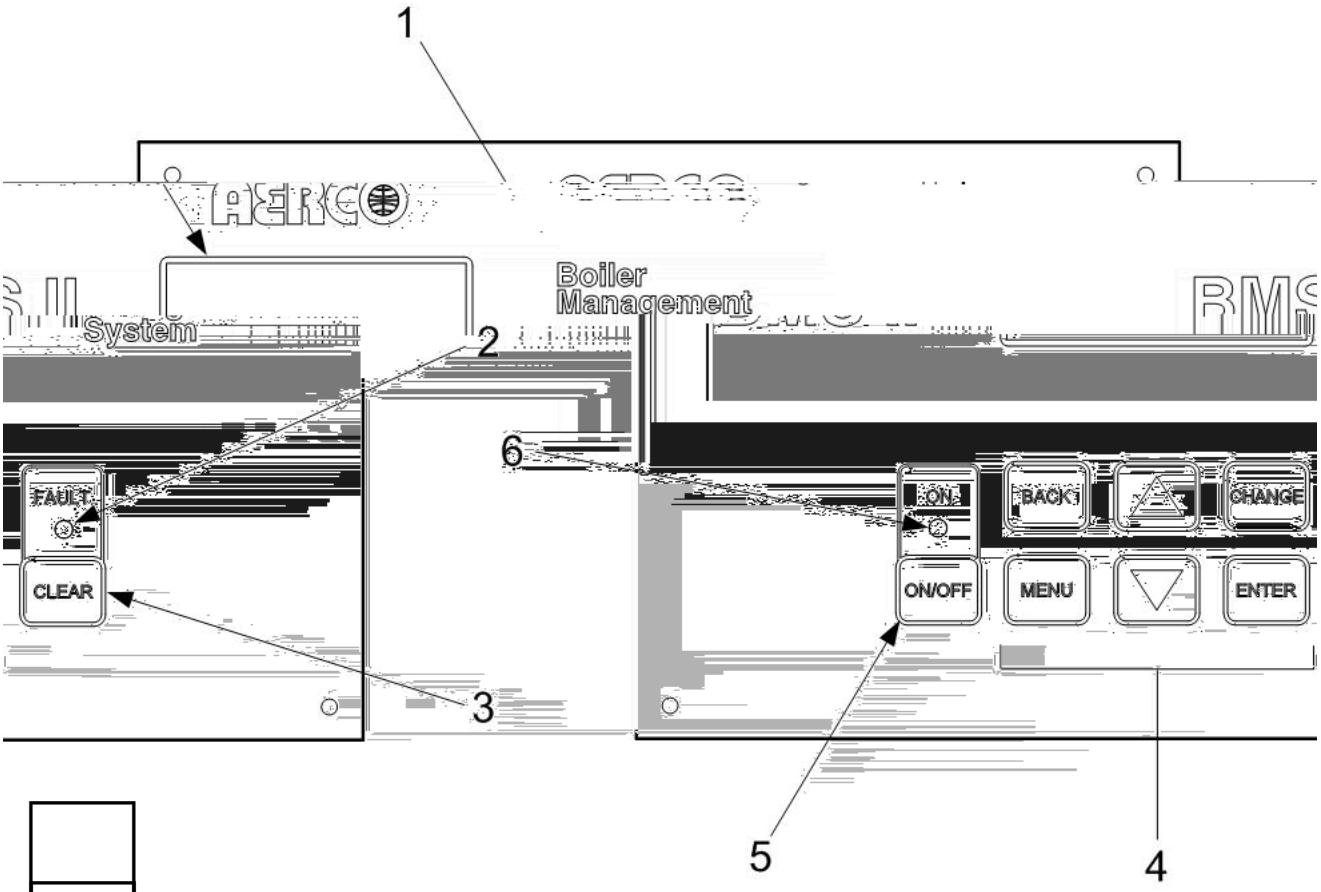


Figure 3-1. BMS II Front Panel Controls and Displays

Table 3-1. BMS II Front Panel Controls and Displays

CONTROL, INDICATOR OR DISPLAY	
FAULT	
CLEAR	
MENU Keypad	
MENU	
BACK	
▲	
▼	
CHANGE	
ENTER	
ON/OFF	
ON	

3.3 [illegible]

- [illegible]
- [illegible]

Menu Processing Procedure

[illegible]

ENTER

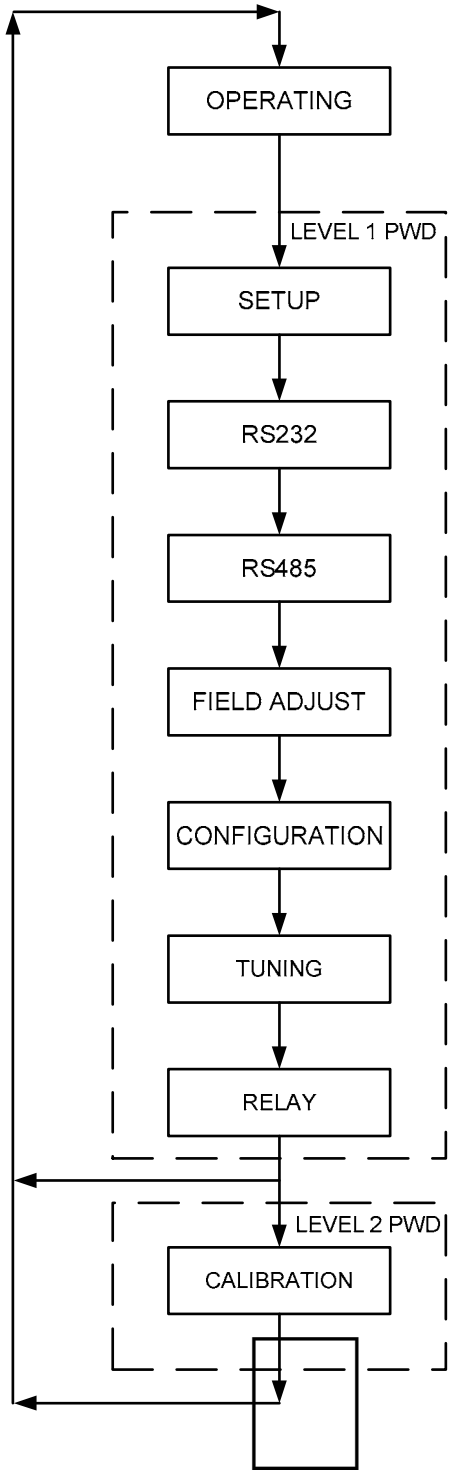
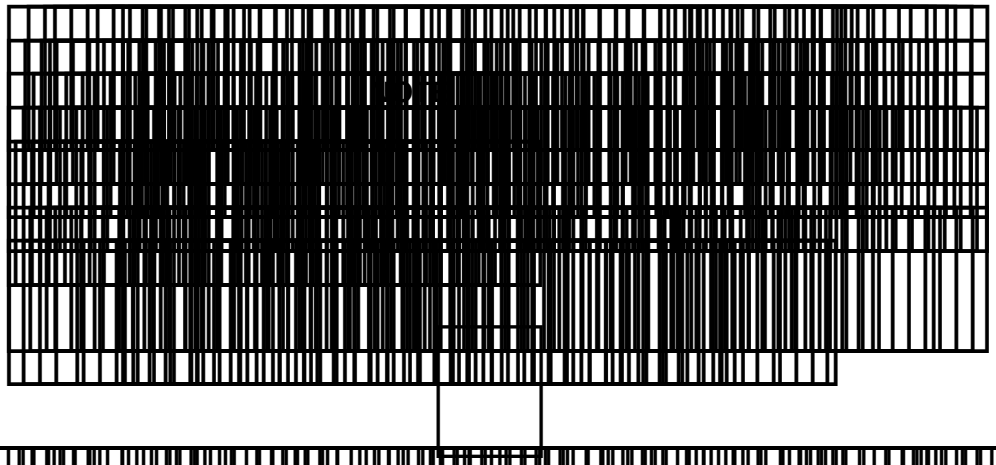
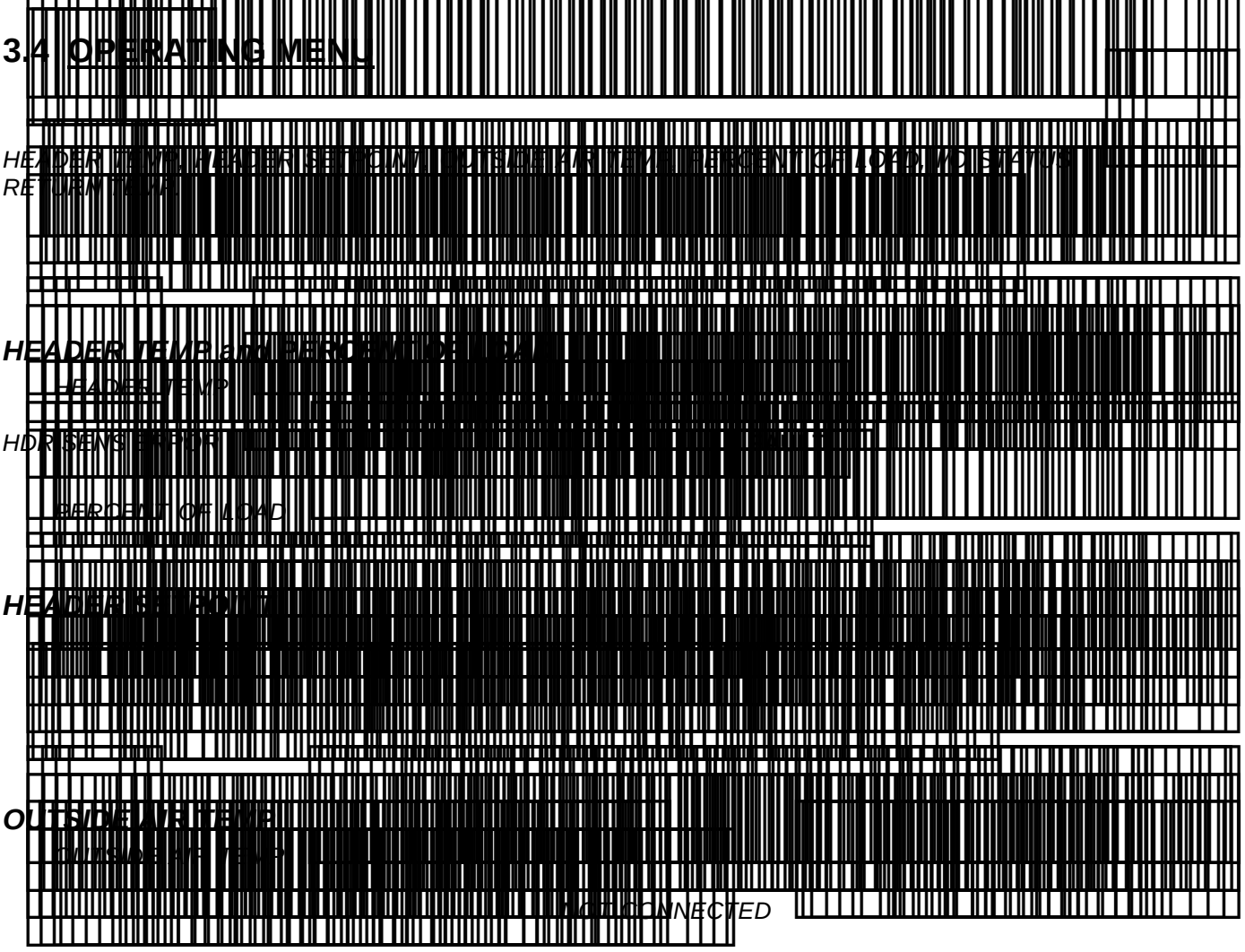


Figure 3-2. BMS II Menu Structure

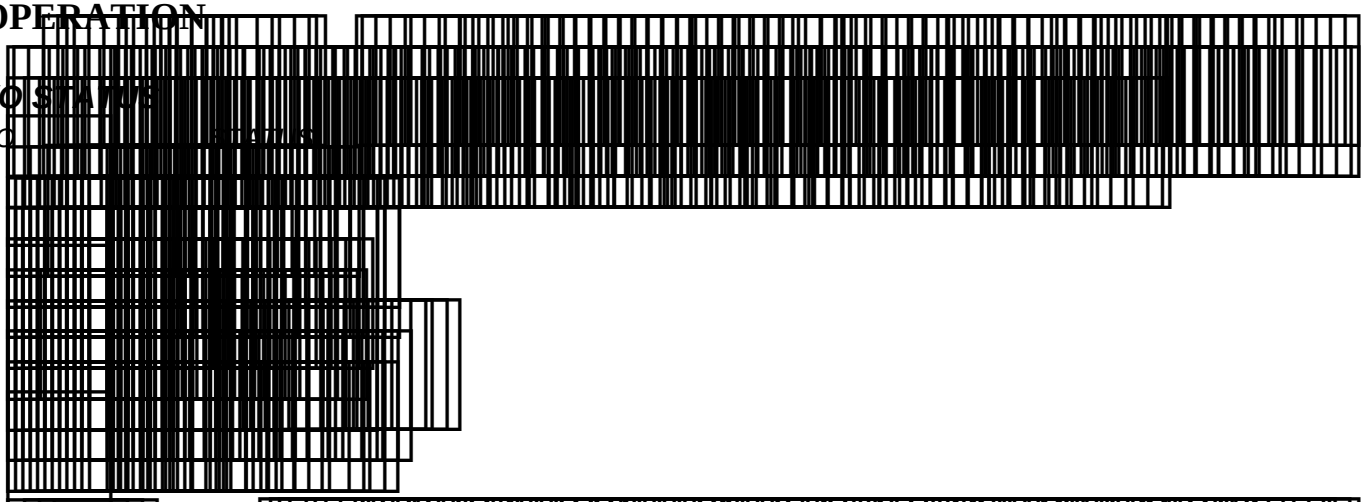


3.4 OPERATING MENU



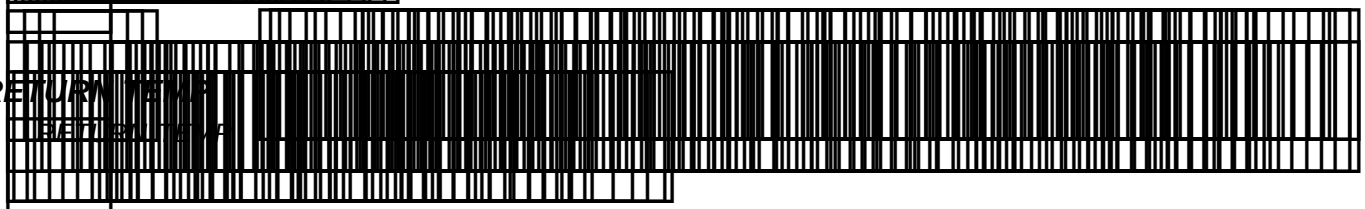
I/O STATUS

I/O [illegible]

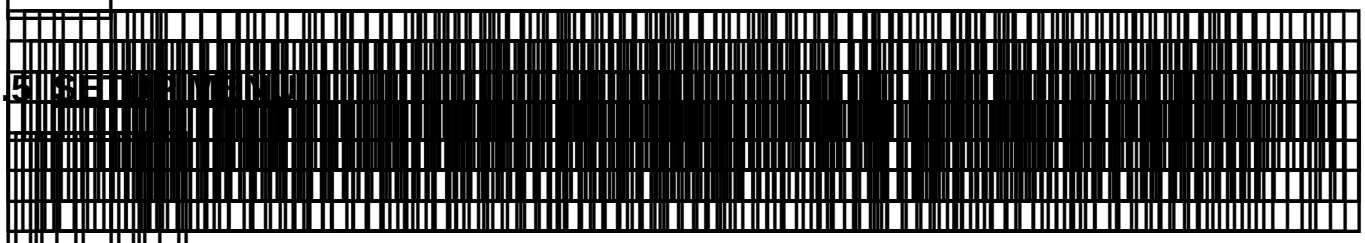


RETURN TEMP

[illegible]

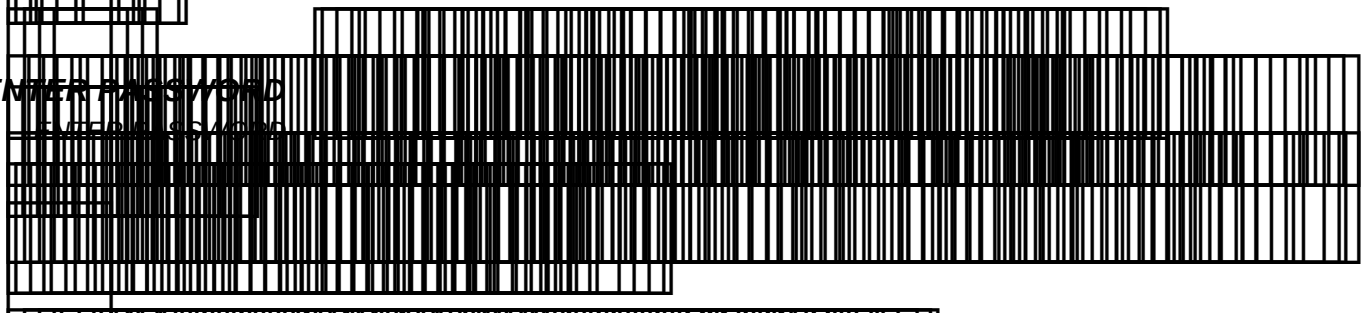


3.5 [illegible]

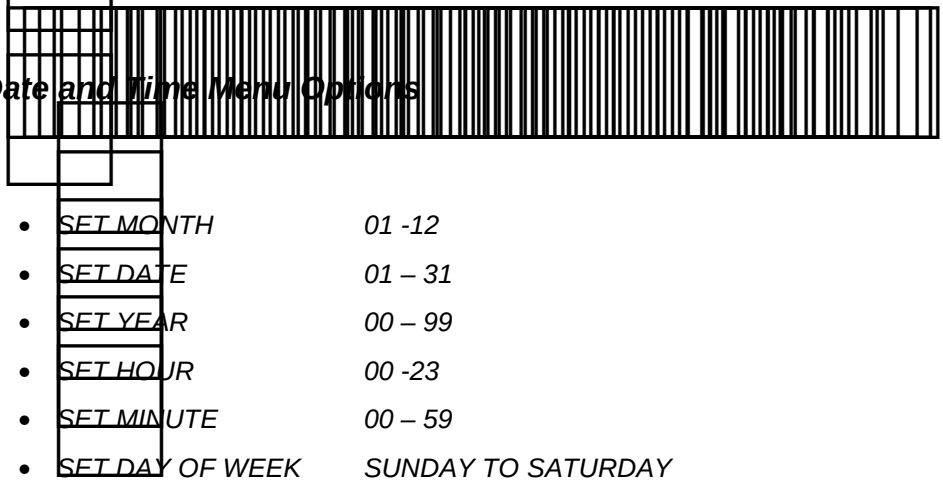


ENTER PASSWORD

[illegible]



Date and Time Menu Options



- *SET MONTH* *01 -12*
- *SET DATE* *01 – 31*
- *SET YEAR* *00 – 99*
- *SET HOUR* *00 -23*
- *SET MINUTE* *00 – 59*
- *SET DAY OF WEEK* *SUNDAY TO SATURDAY*

3.6 RS232 MENU

RS232 MENU

RS232 MODE

RS232 BAUD RATE

MODBUS ADDRESS

MODBUS ADDRESS

NETWORK TIMEOUT

MODBUS PASSTHRU

3.7 RS485 MENU

RS485 BAUD RATE

RS485 BAUD RATE

MIN SLAVE ADDR

MIN SLAVE ADDR

MAX SLAVE ADDR

MAX SLAVE ADDR

NUMBER NETWK ERRS

MODBUS DATA TYPE

ROBIN

NETWORK CONTROL

MIN SLAVE ADDR

MIN SLAVE ADDR

3.8 FIELD ADJUSTMENT

HEADER SET MODE

HEADER SET MODE

HDR HIGH LIMIT

HDR LOW LIMIT

HDR LOW LIMIT

HDR MOM TIME

HEADER LIMIT

INTERNAL SETPT

INTERNAL SETPT *HEATER SETPT* *CONSTANT SETPT*

HEADER SET MODE *CONSTANT SETPT*

RESET RATIO

RATIO

HEADER SET TEMP

BLDG REF TEMP

BLDG REF TEMP *HEADER SET MODE*

OUTDOOR RESET *(BLDG REF TEMP)*

REMOTE SIGNAL

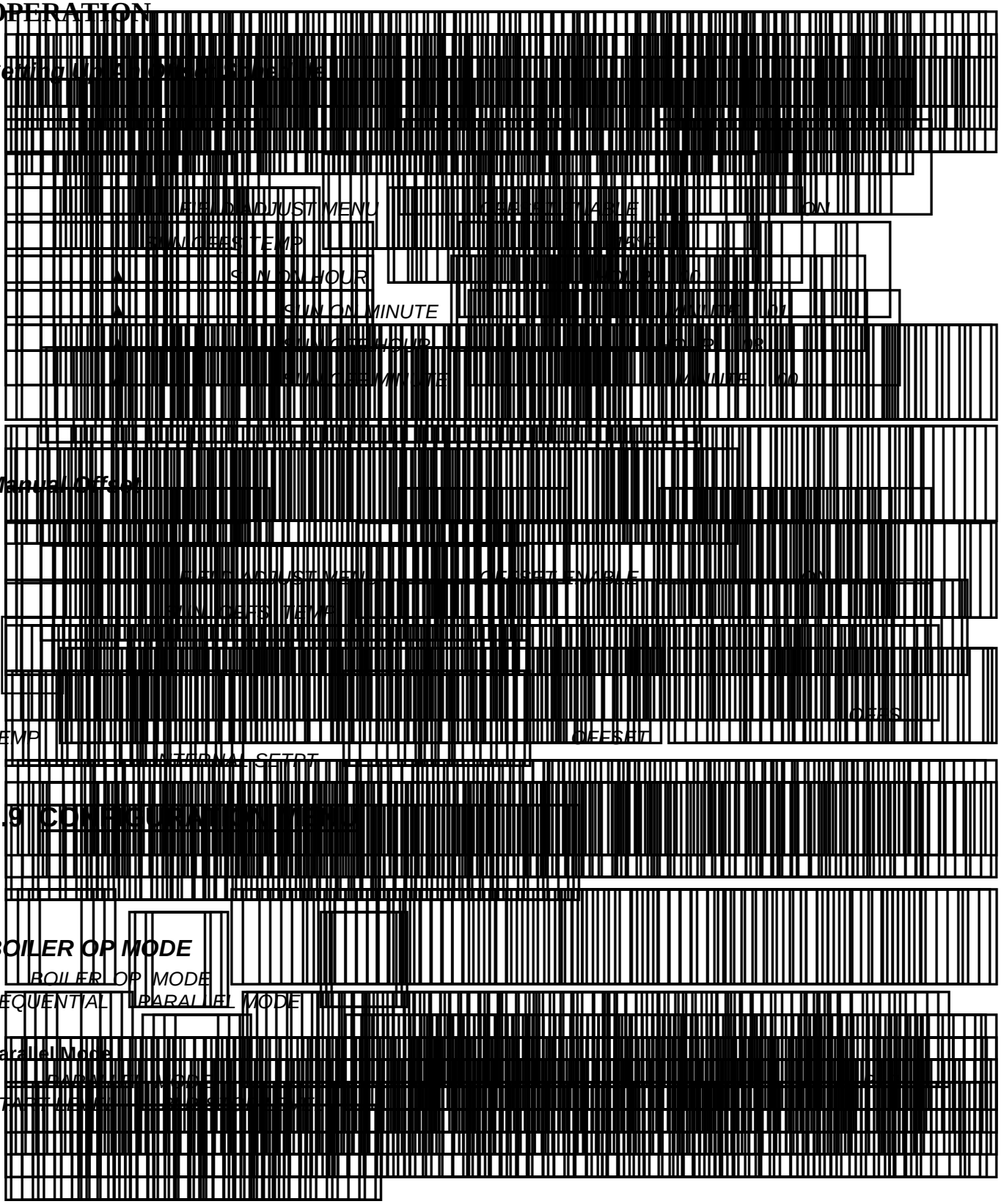
REMOTE SIGNAL *HEADER SET MODE* *REMOTE SETPT*

OFFSET ENABLE

OFFSET ENABLE

Offset Menu Options

- *OFFS TEMP*
- *ON HOUR (00 to 23)*
- *ON MINUTE (00 to 59)*
- *OFF HOUR (00 to 23)*
- *OFF MINUTE (00 to 59)*



Manual Offset

3.9 CONFIGURATION MENU

BOILER OP MODE

Parallel Mode

Sequential

SYS INTLK CONFIG

ENABLED

NOTE:

BLR START LEVEL *BLR STOP LEVEL*

START/STOP LEVELS

BLR START LEVEL

BLR START LEVEL

BLR STOP LEVEL

BLR STOP LEVEL

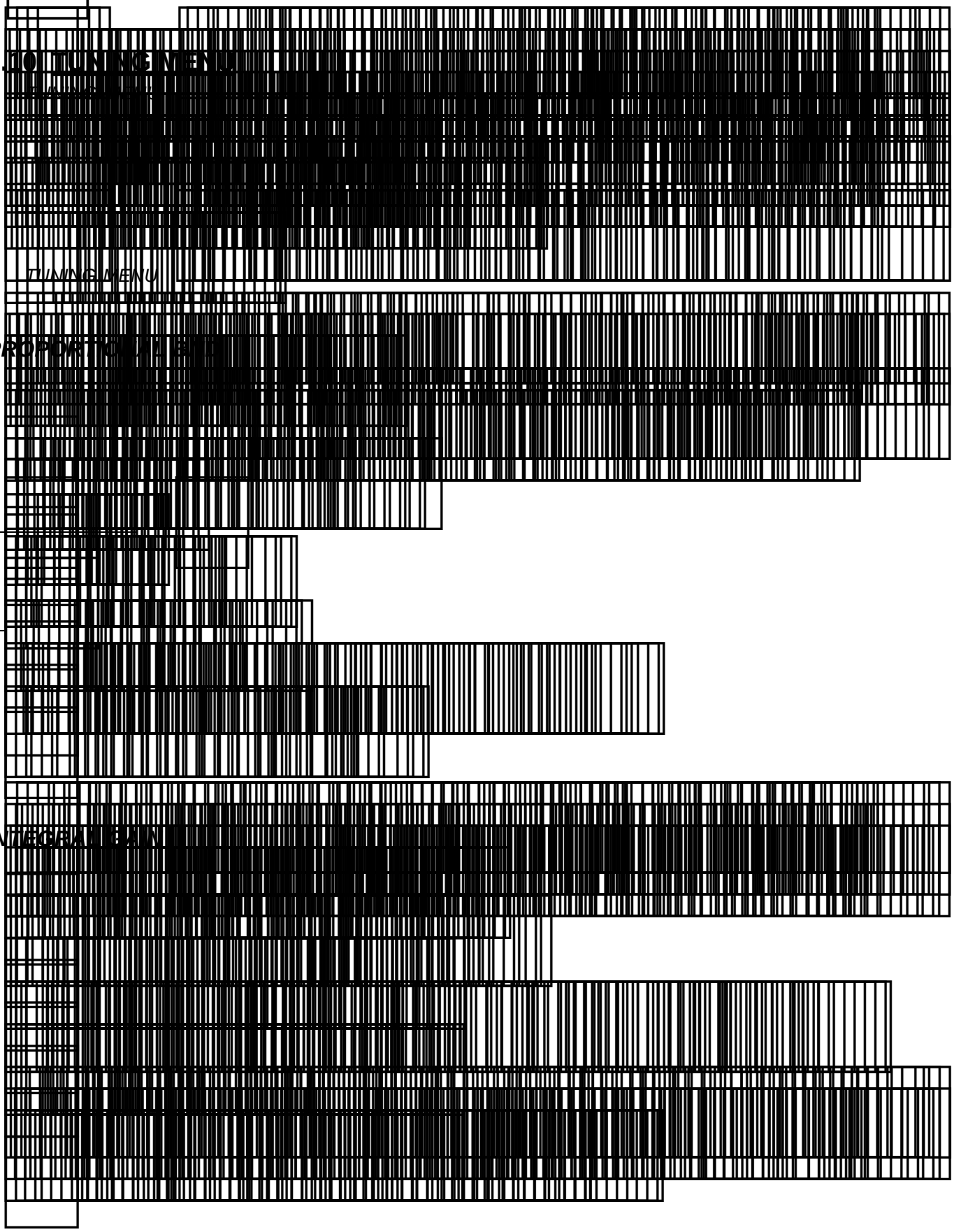
MAX POWER INPUT

MAX POWER INPUT

FAIL SAFE MODE

NOTE:

3.10 TUNING MENU



TUNING MENU

PROPORTIONAL

INTEGRAL

DERIVATIVE (D)

HDR TEMP DEADBAND

3.11 RELAY MENU

RELAY MENU

SYS START TIMER

SYS START OPTION

LOAD START PCT

SYS START INTLK

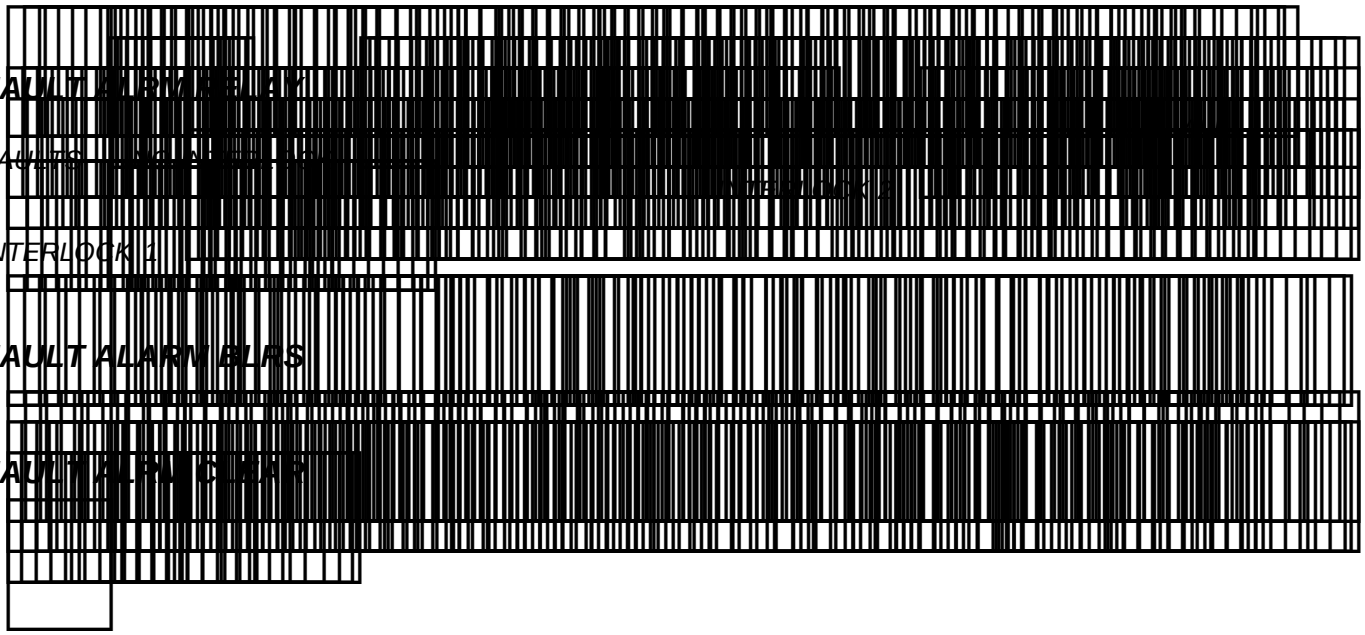
SYS START INTLK

SYS INTLK CONFIG *START ENABLED* *INTERLOCK 1 (default), INTERLOCK 2, INTERLOCK 1&2.*

AUX RELAY OPEN

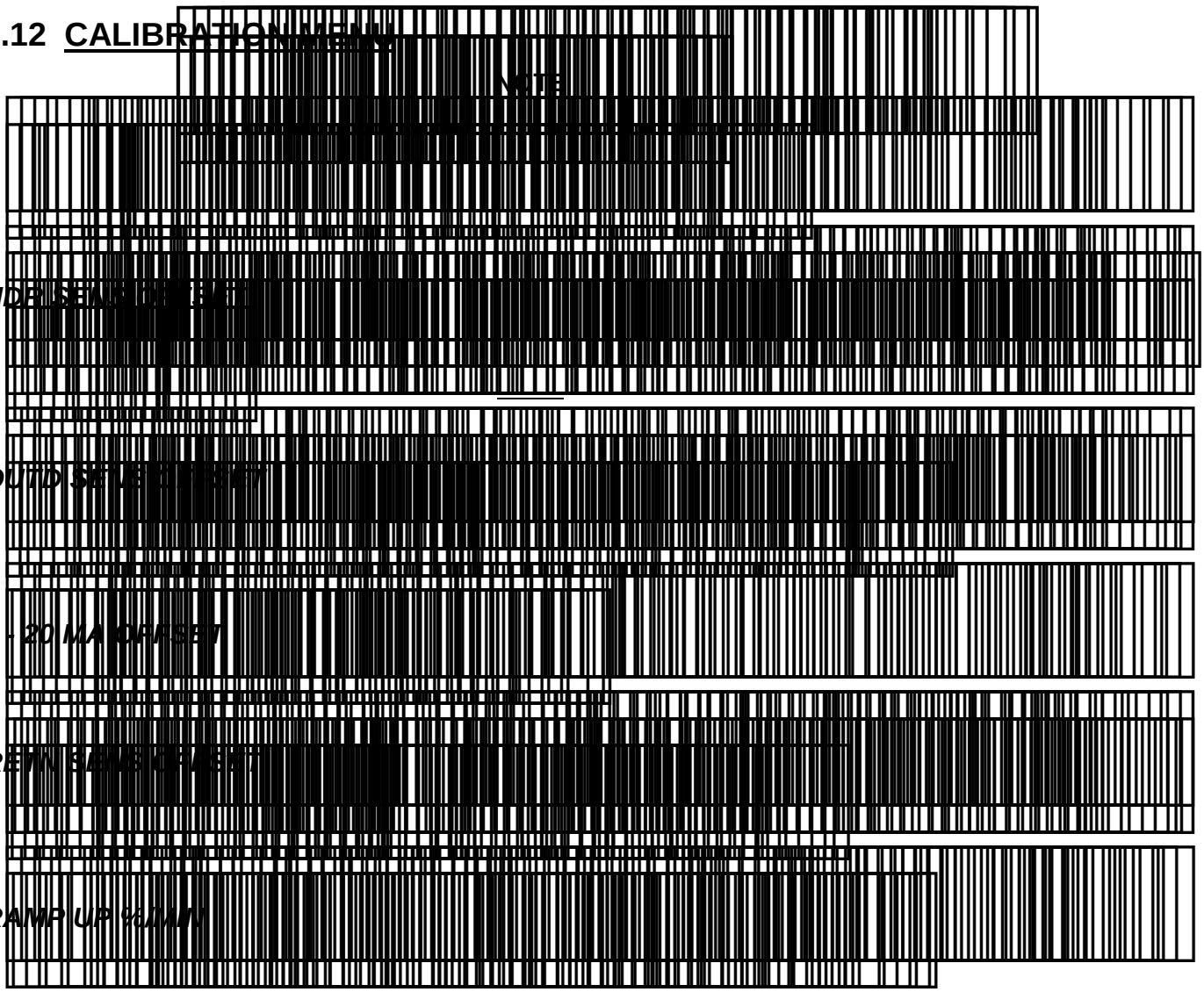
AUX RELAY OPEN

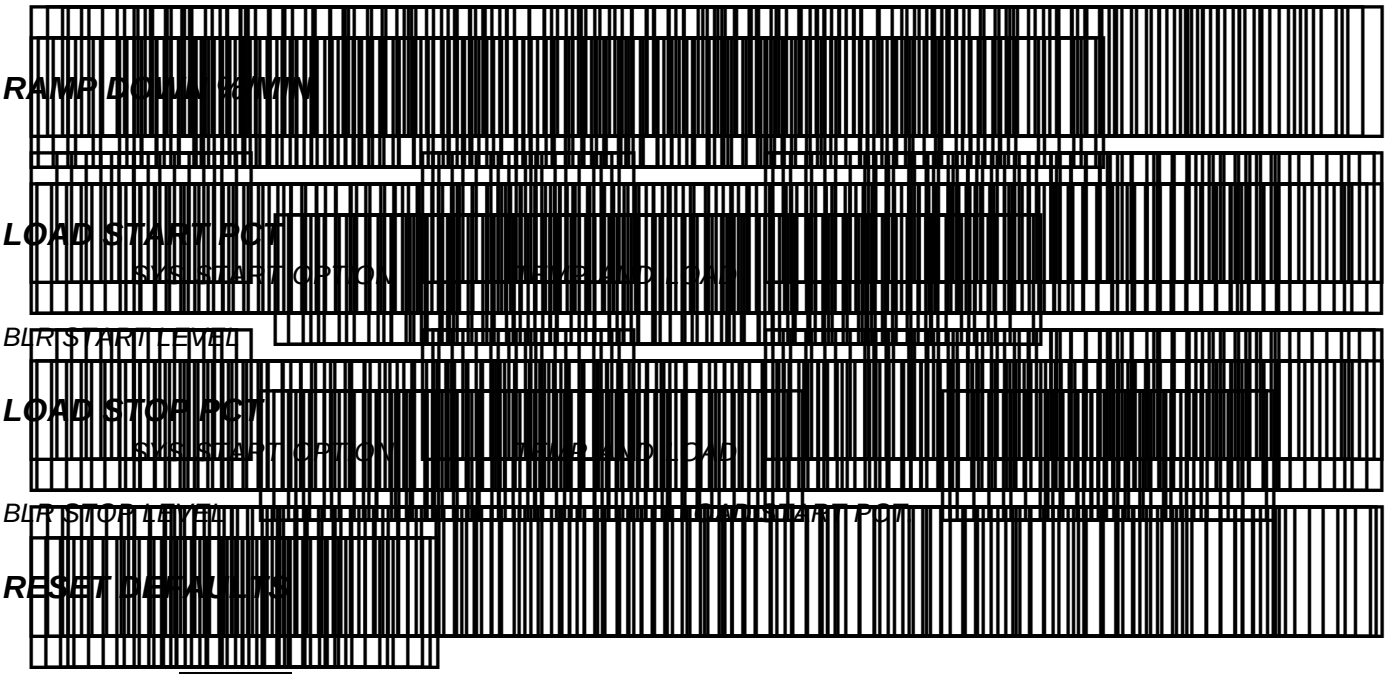
AUX RELAY CLOSE



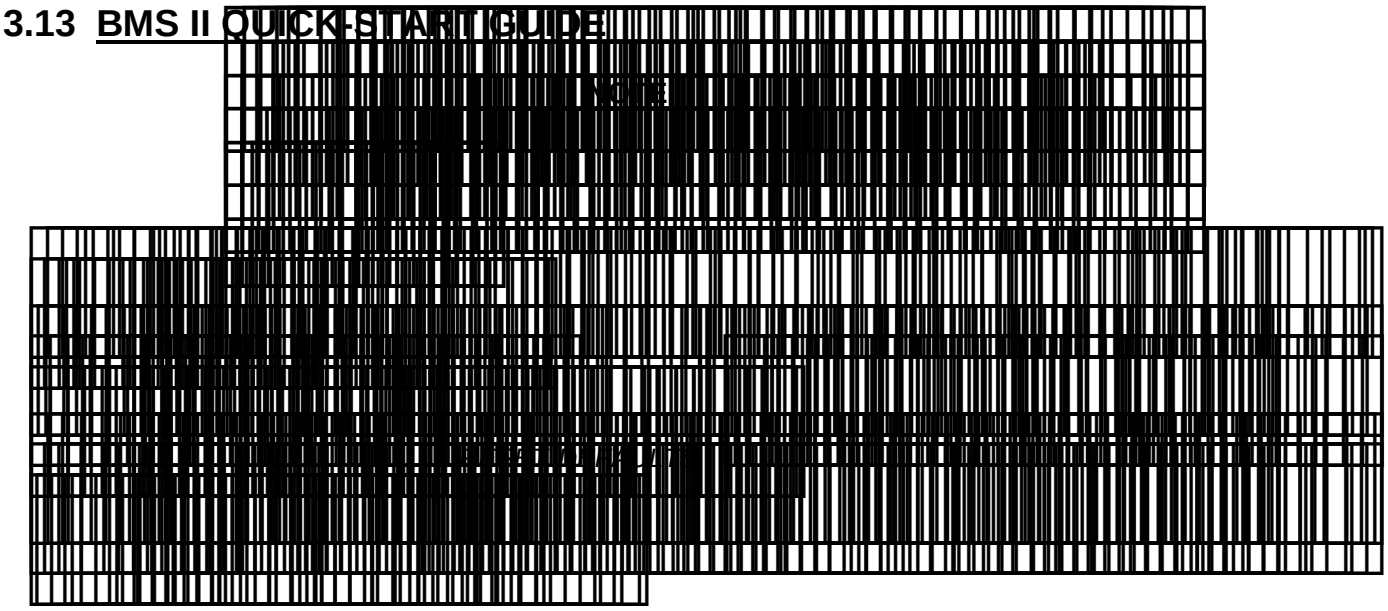
3.12 CALIBRATION MENU

NOTE





3.13 BMS II QUICK START GUIDE



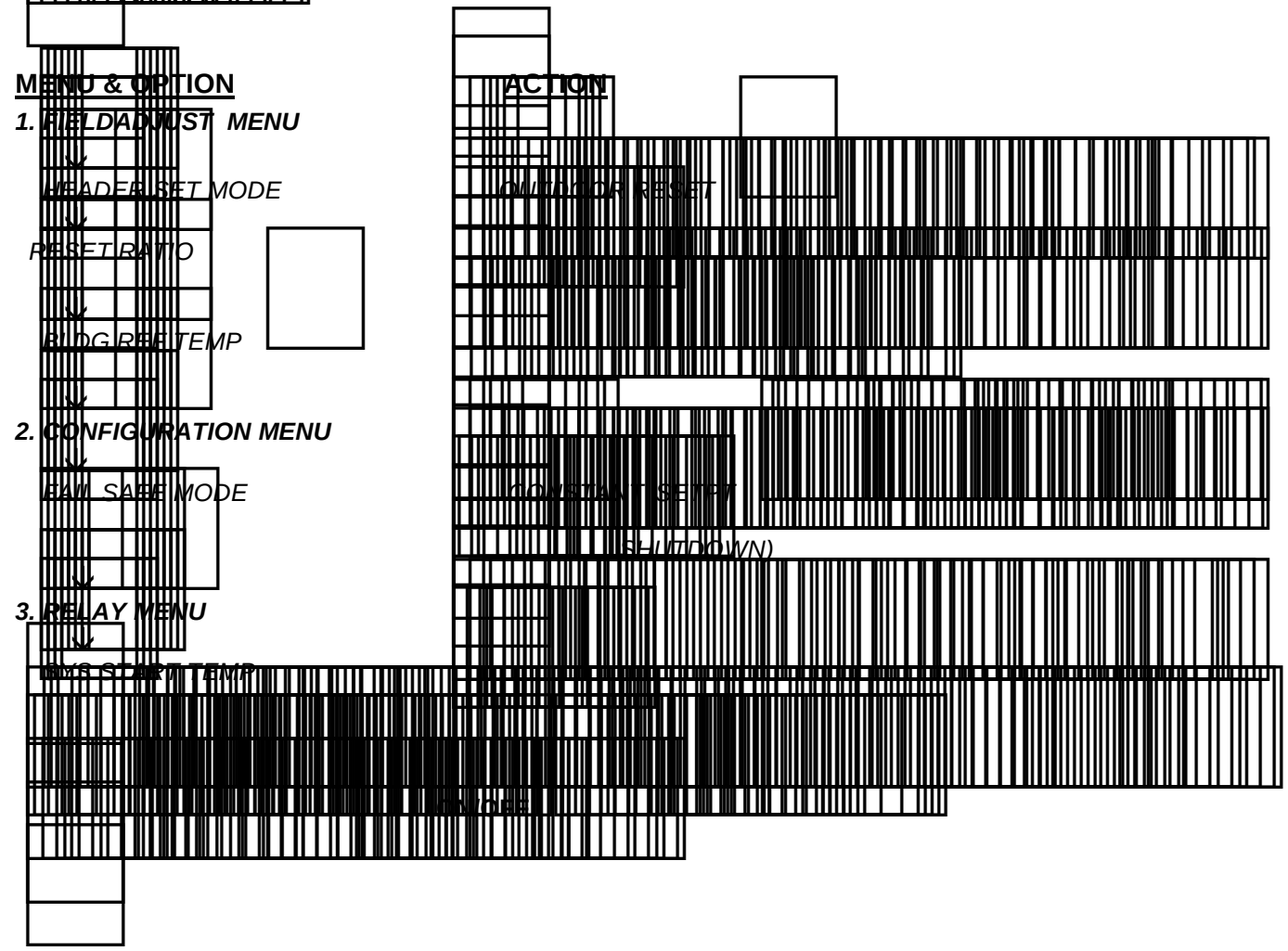
CONSTANT SETPT MODE (Default)

MENU & OPTION	ACTION
1. SETUP MENU	
ENTER PASSWORD	
2. RS485 MENU	
NUMBER NETW BOILERS	
NETW BOILER 01 ADDRESS=001	
3. FIELD ADJUST MENU	
INTERNAL SETPT	
4. CONFIGURATION MENU	*BLR START LEVEL=20% & BLR STOP LEVEL=16%*
BLR START LEVEL	
BLR STOP LEVEL	

REMOTE SETPT MODE

MENU & OPTION	ACTION
1. FIELD ADJUST MENU	
HEADER SET MODE	*(4-20 mA SETPT)*
HDR HIGH LIMIT	
HDR LOW LIMIT	
REMOTE SIGNAL	
2. CONFIGURATION MENU	
FAIL SAFE MODE	*(CONSTANT SETPT SHUTDOWN)*

OUTDOOR RESET MODE



CHAPTER 4 - PROGRAMMING BMS II OPERATING MODES

4.1 INTRODUCTION

4.2 OUTDOOR RESET MODE

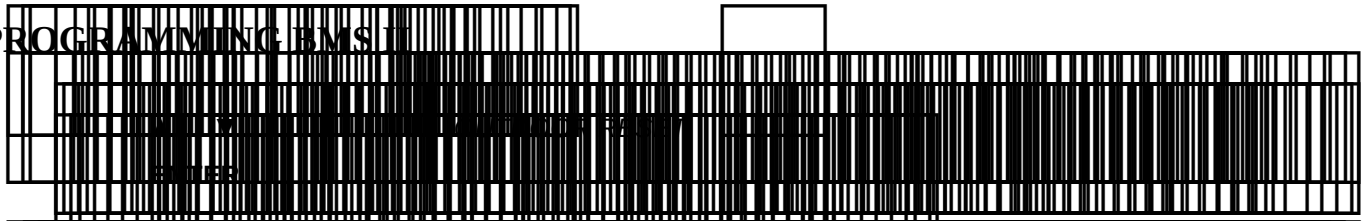
-
  - o
  - o
  - o
-
  - o
-
  - o

Selecting Outdoor Reset Mode

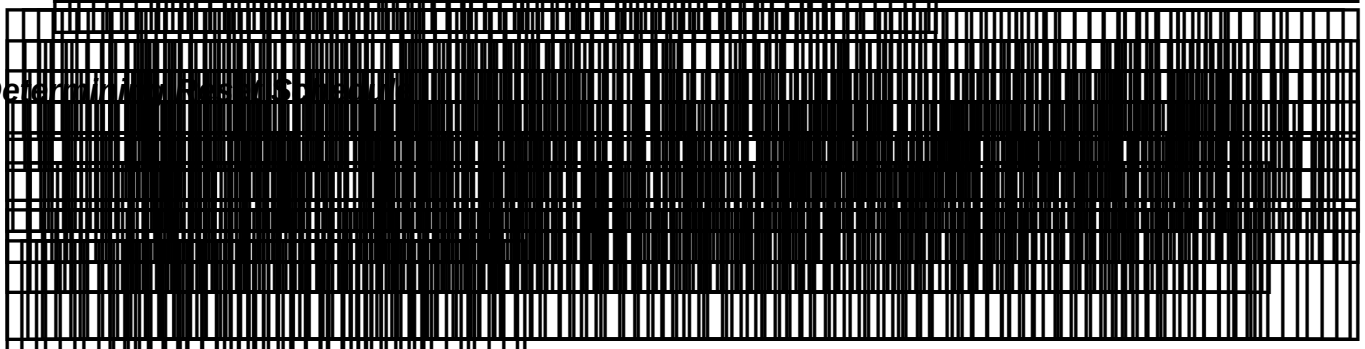
OUTDOOR RESET

OUTDOOR RESET

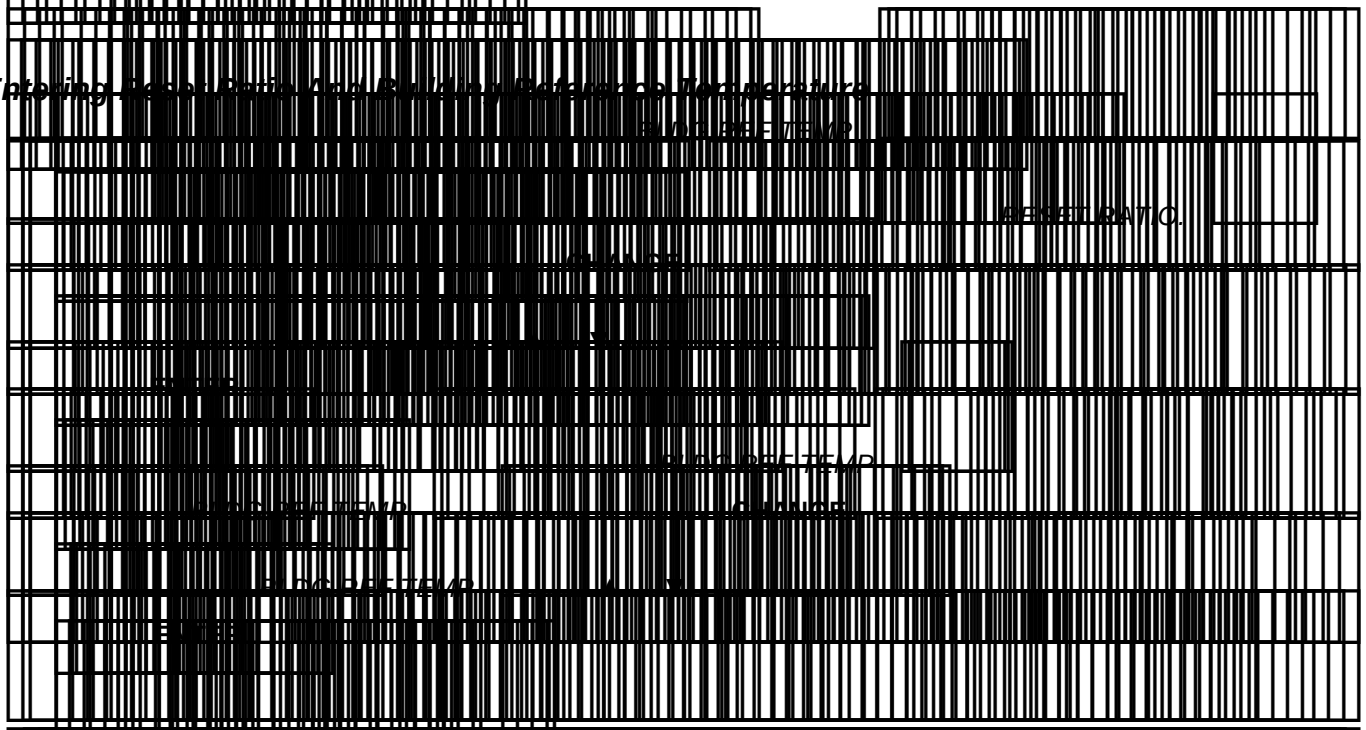
PROGRAMMING BMS



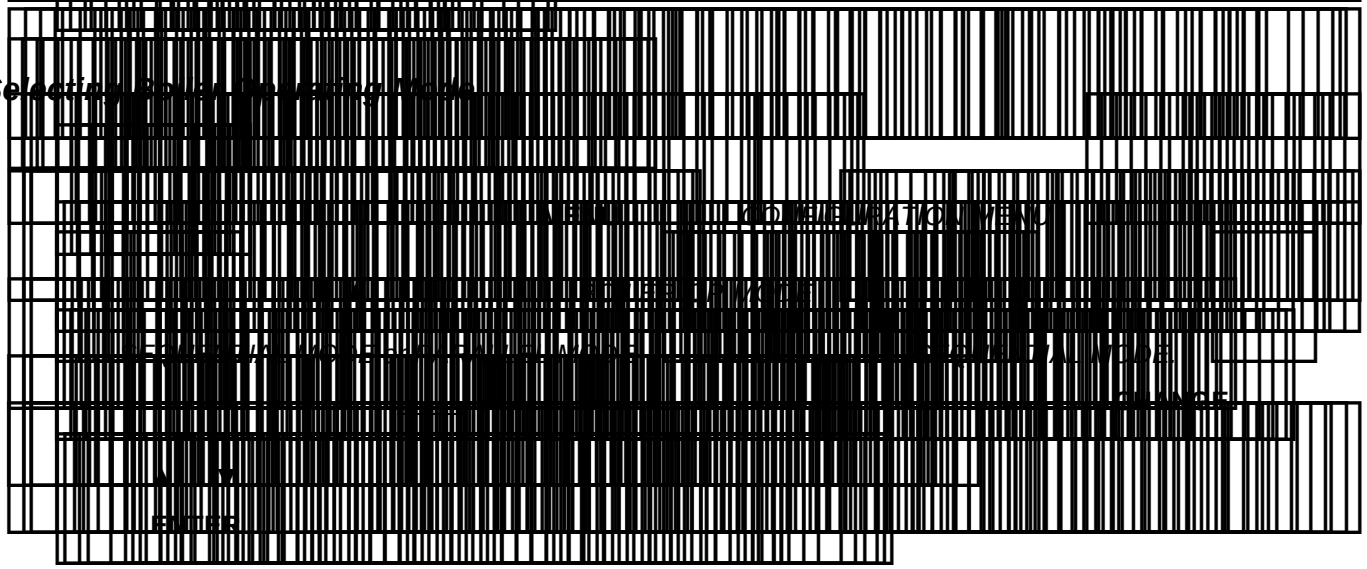
Deleting

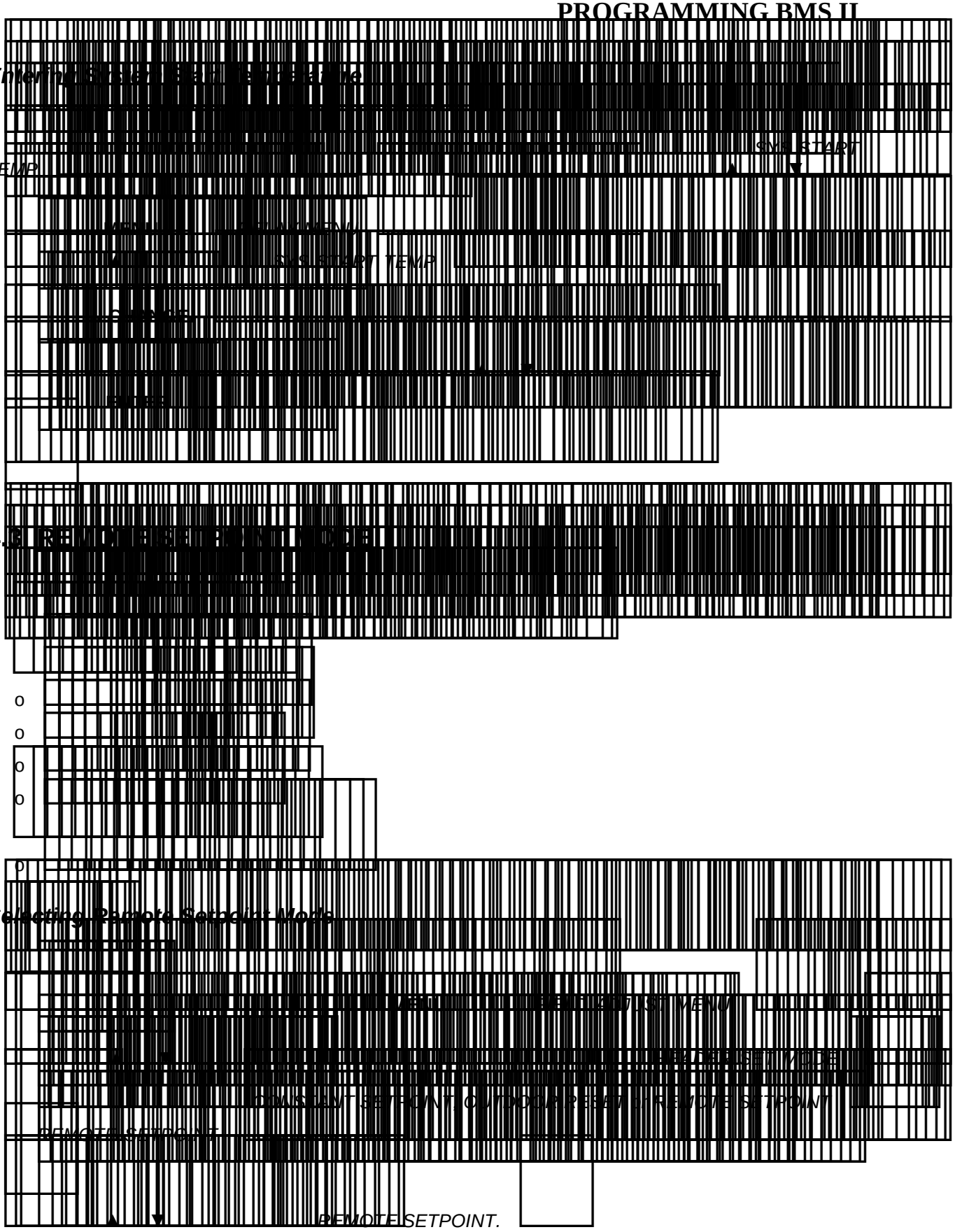


Entering



Selecting





Entering Remote Setpoint Mode

SYS START TEMP

TEMP.

SYS START TEMP

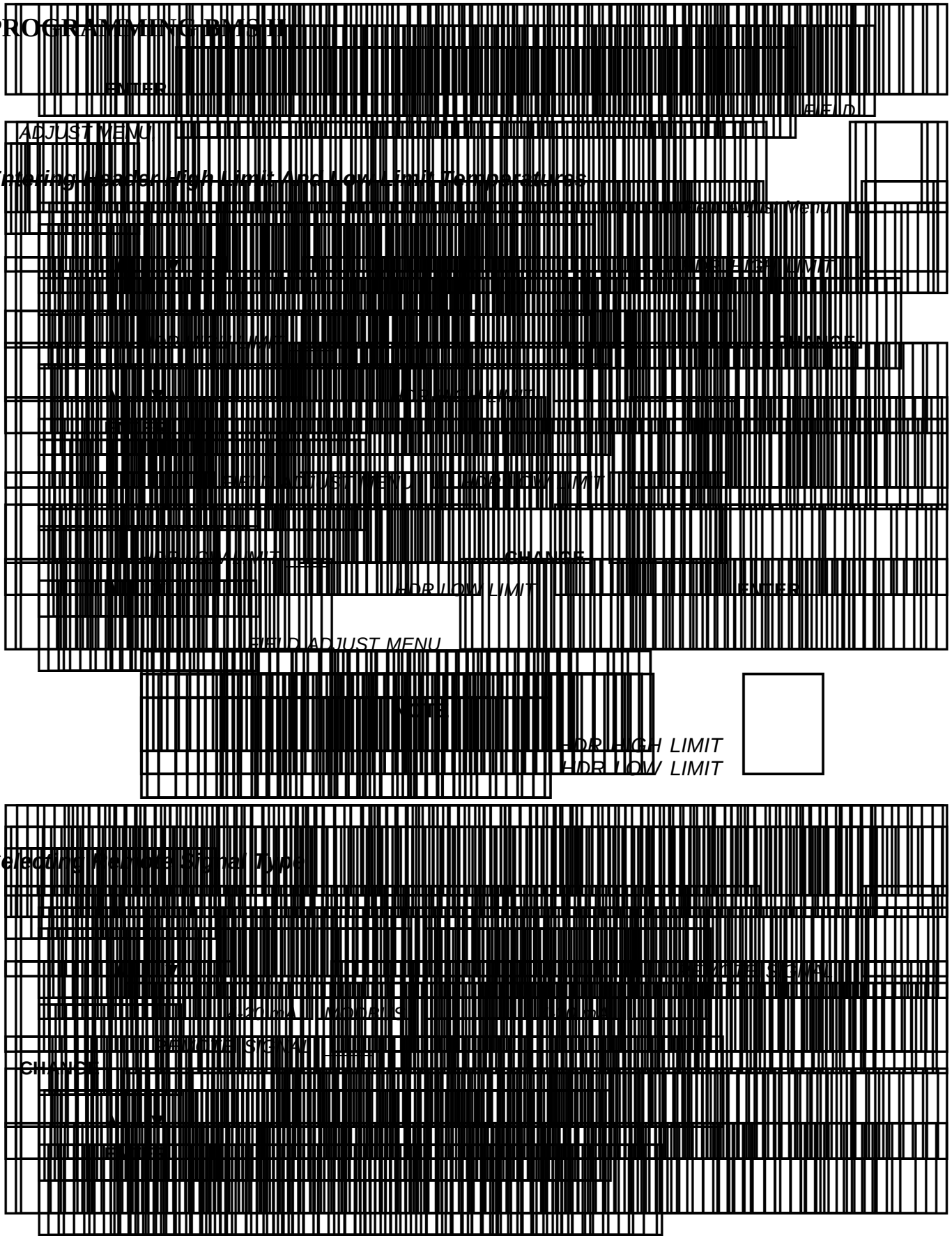
4.6 REMOTE SETPOINT MODE

- o
- o
- o
- o
- o

Selecting Remote Setpoint Mode

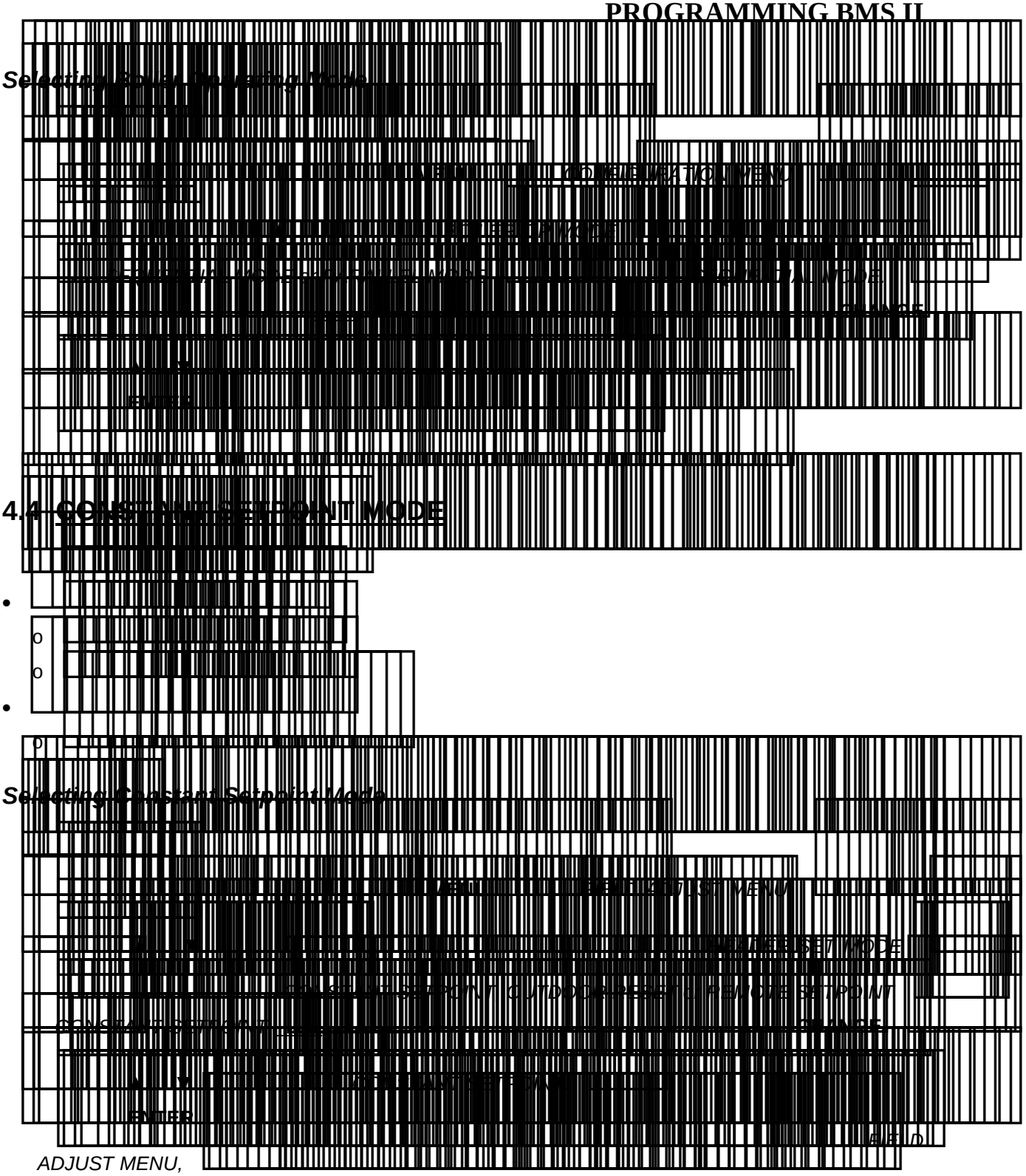
REMOTE SETPOINT.

PROGRAMMING EXAMPLE



Entering a Rack High Limit And Low Limit Temperature

Selecting Alarm Type

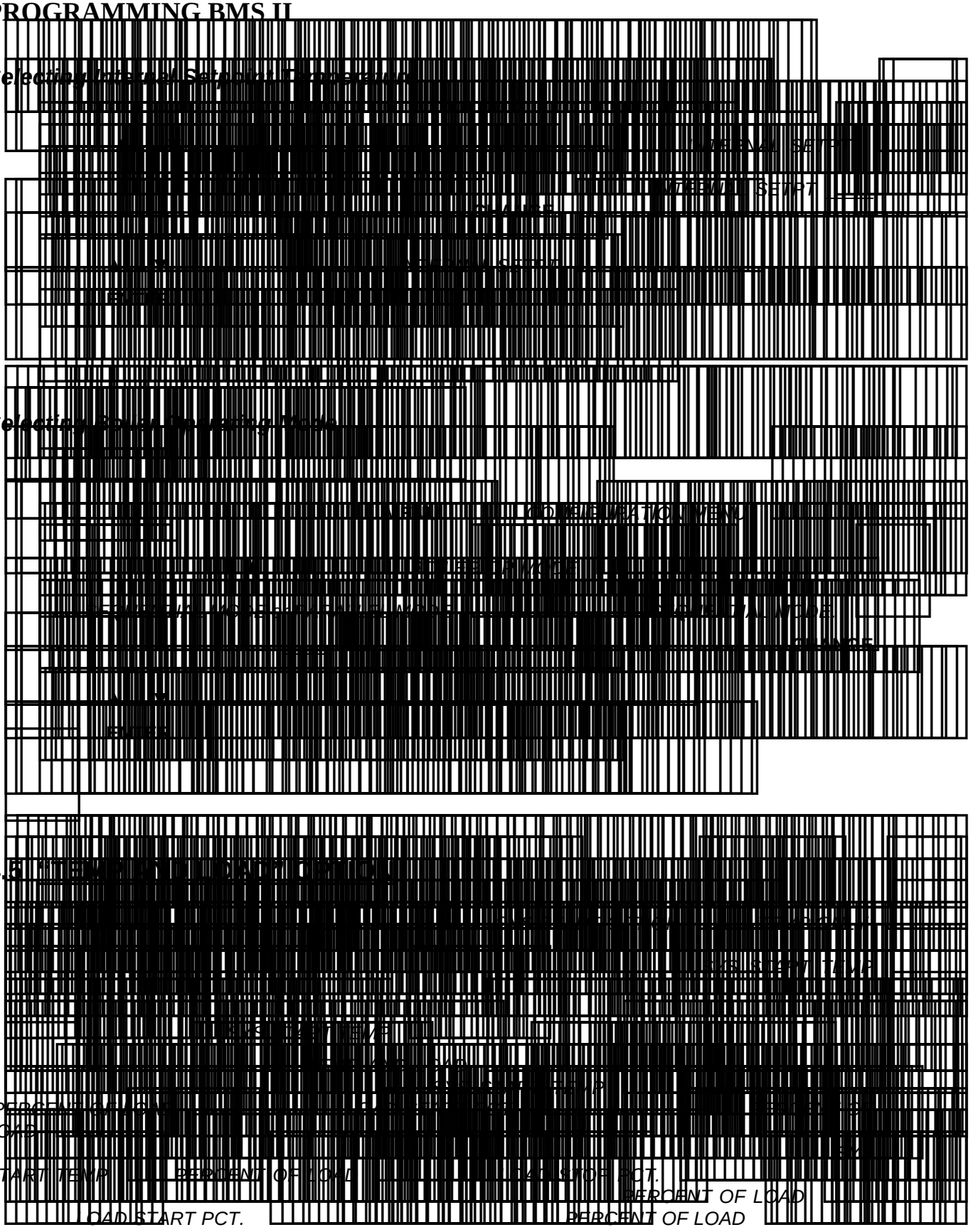


4.4 CONSTANT SETPOINT MODE

-
  - o
  - o
-
  - o

Selecting Constant Setpoint Mode

ADJUST MENU,

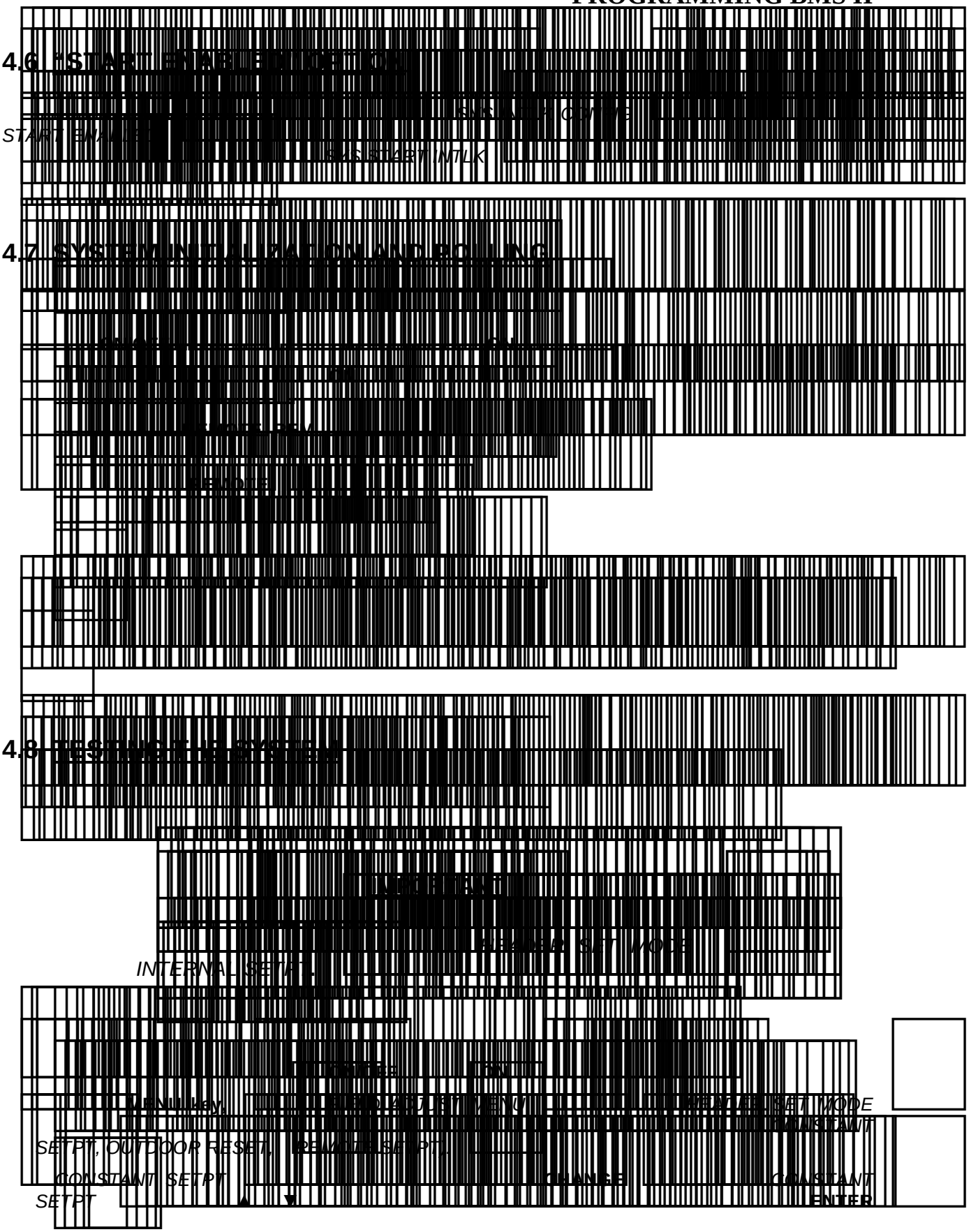


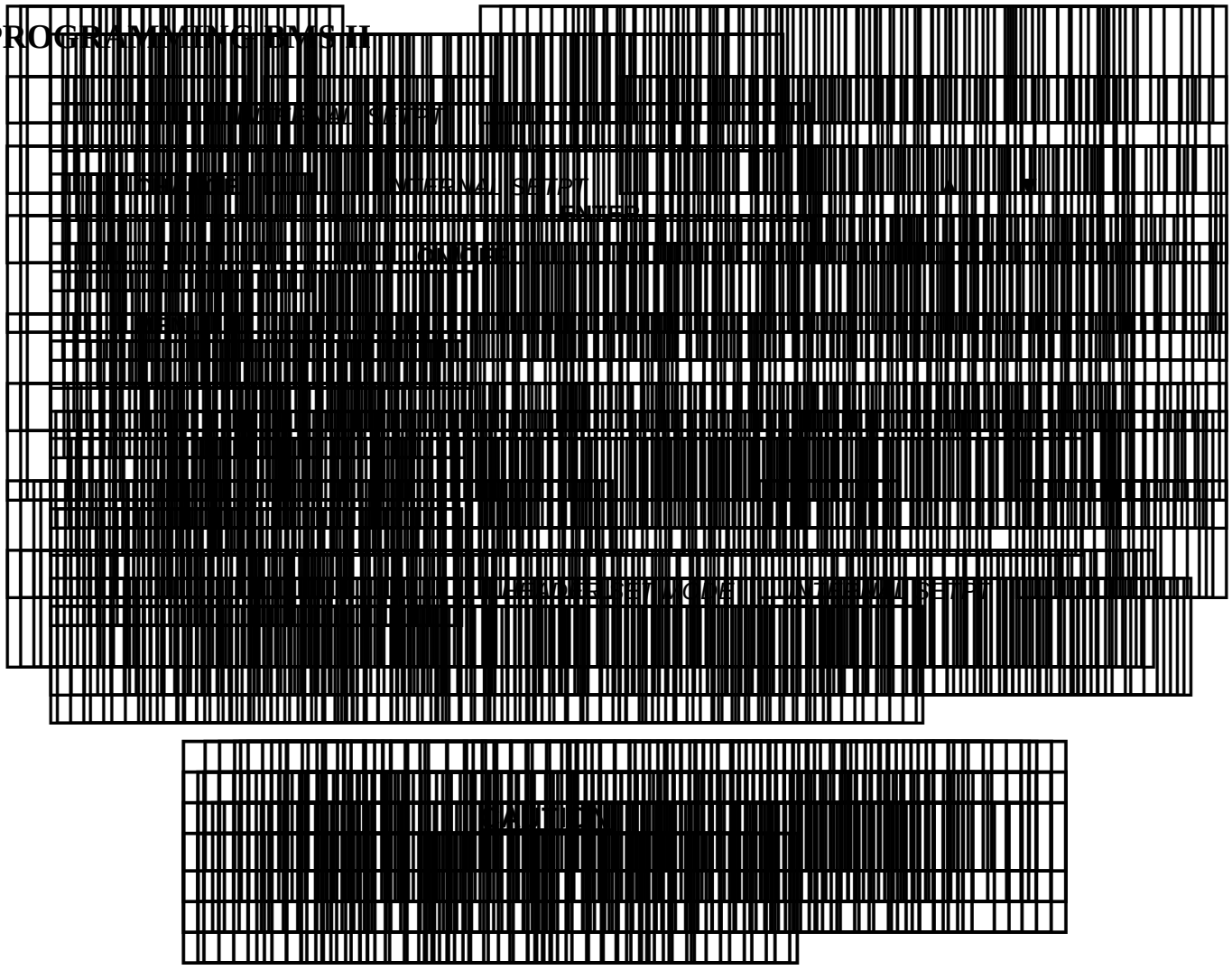
PERCENT OF LOAD
LOAD START PCT.
LOAD STOP PCT.

4.6 START ENABLE/DISABLE CONTROL

4.7 SYSTEM INSTALLATION AND POWERING

4.8 TESTING THE SYSTEM





CHAPTER 5 - TROUBLESHOOTING

5.1 FAULT MESSAGES AND POSSIBLE PROBLEMS

Table 5-1. Fault Messages

Fault Message	Description & Possible Causes

Table 5-1. Fault Messages – Continued

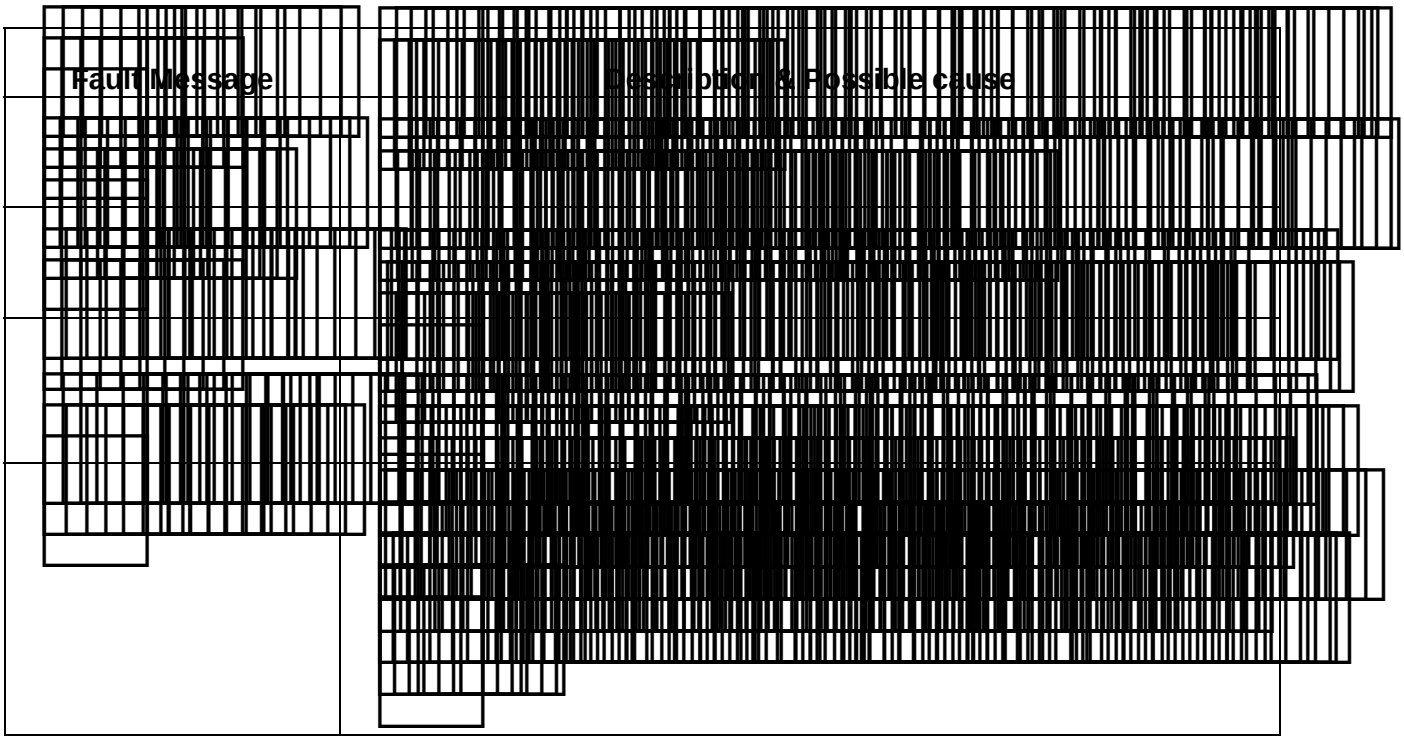


Table 5-2 Common Problems

Problem	Possible Causes	Solution
Boiler plant not started by BMS II	•	
	•	
	•	
	•	
	•	
BMK or KC Boiler with C-More Control Box not being recognized by BMS II.	•	
	•	
	•	
	•	
Modulex Boiler with BCM Control not being recognized by BMS II.	•	
	•	
	•	
	•	
BMS II controlling boilers. EMS can see BMS II, but cannot see boilers.	•	
	•	

Table 5-2 Common Problems - Continued

Problem	Possible Causes	Solution
EMS cannot see BMSII	•	
Boiler *RAMP UP* or *RAMP DOWN too slow or too fast*	• *RAMP UP* *RAMP DOWN*	*RAMP UP %/MIN* *RAMP DOWN %/MIN*
HEADER TEMPERATURE not reaching Setpoint	•	*HEATER DEMAND*
Need to restore Factory Default Settings.	•	*RESET TO DEFAULTS*
Boilers over-shooting setpoint or tripping aquastat	•	
Modbus Network faults encountered. Boiler plant not operating	•	

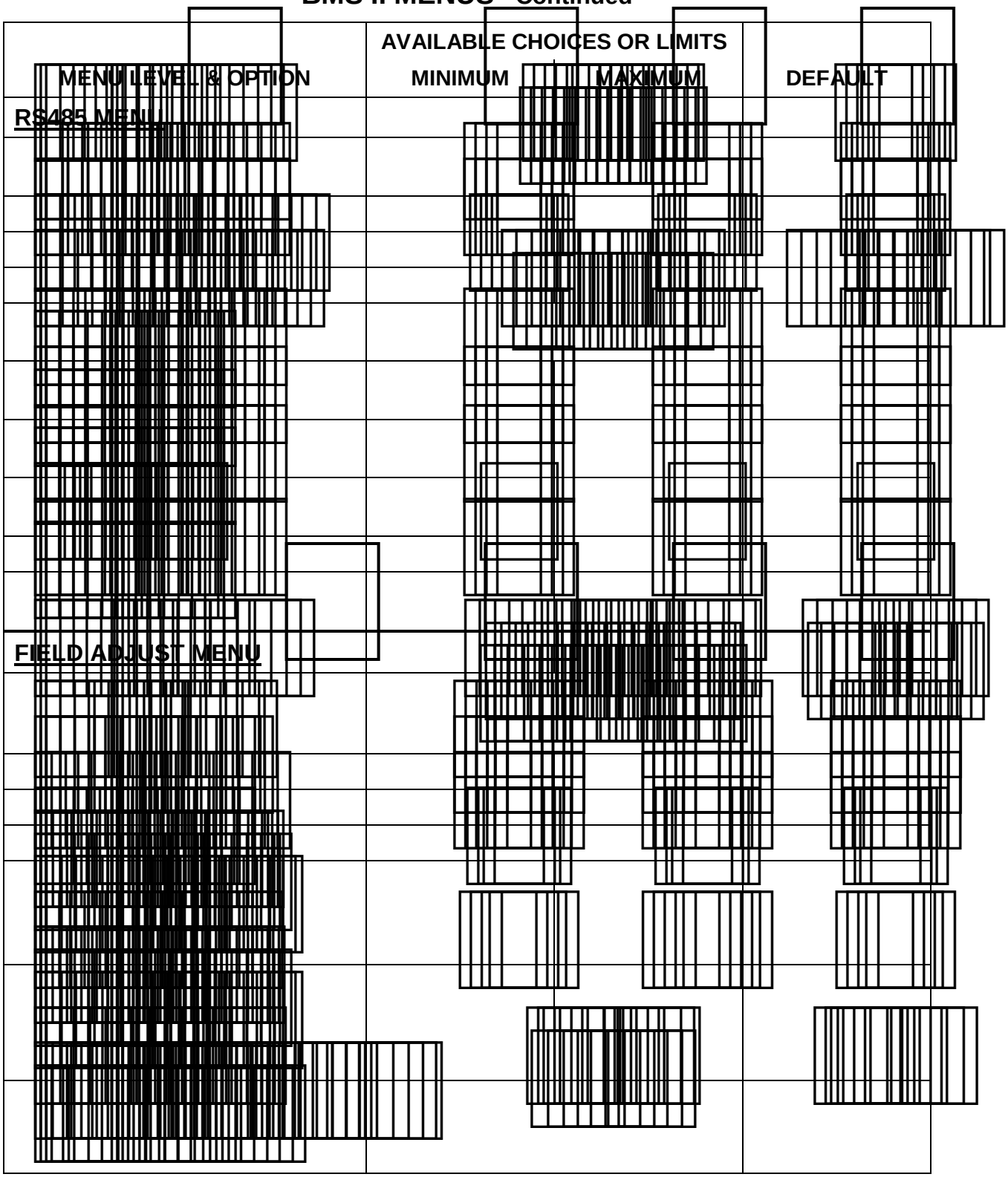
APPENDIX A

BMS II MENUS

MENU LEVEL & OPTION	AVAILABLE CHOICES OR LIMITS MINIMUM	MAXIMUM	DEFAULT
OPERATING MENU			
SETUP MENU			
RS232 MENU			

APPENDIX A

BMS II MENUS - Continued



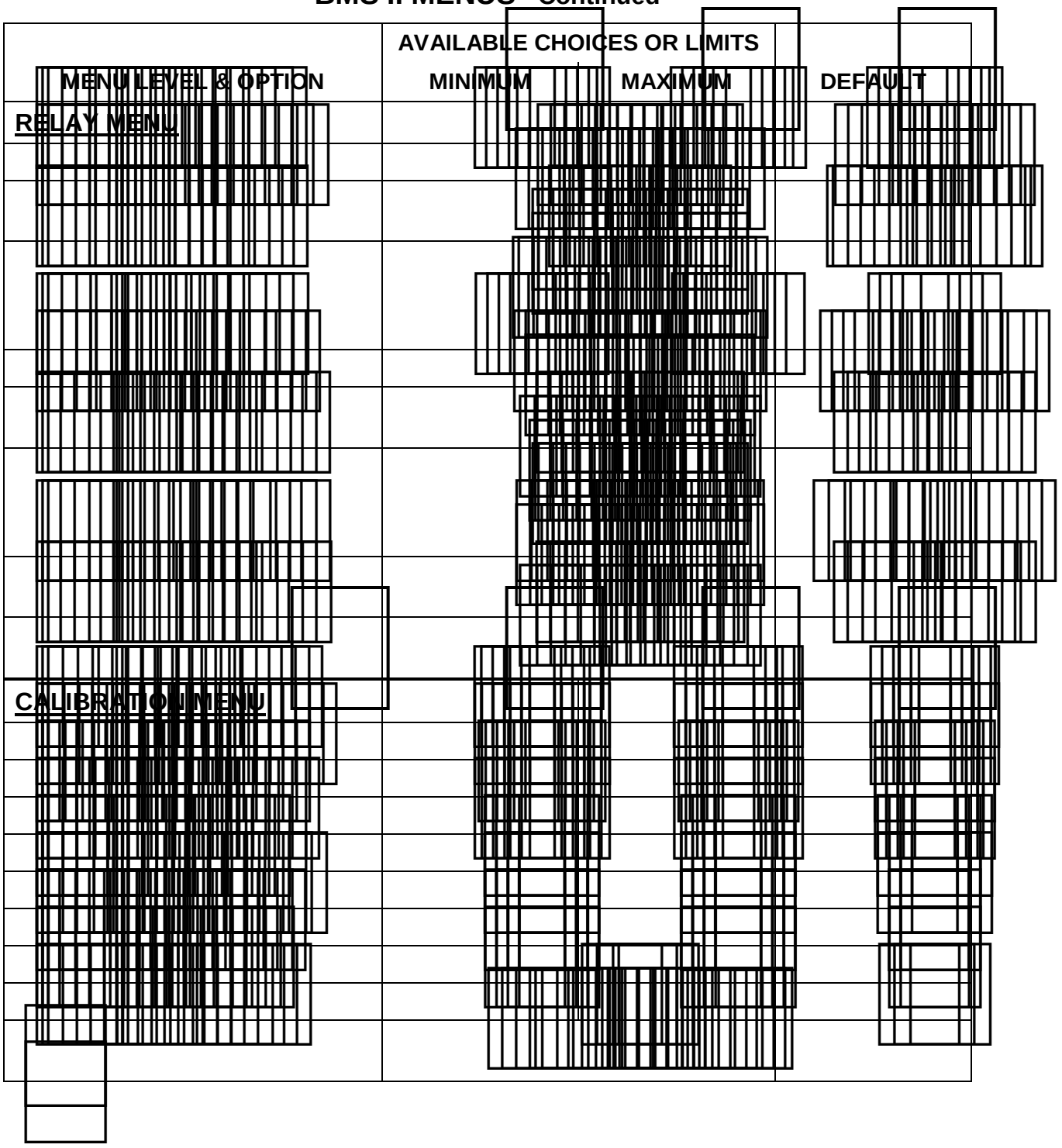
APPENDIX A

BMS II MENUS - Continued

MENU LEVEL & OPTION	AVAILABLE CHOICES OR LIMITS MINIMUM	MAXIMUM	DEFAULT
FIELD ADJUST MENU – Cont.			
CONFIGURATION MENU			
TUNING MENU			

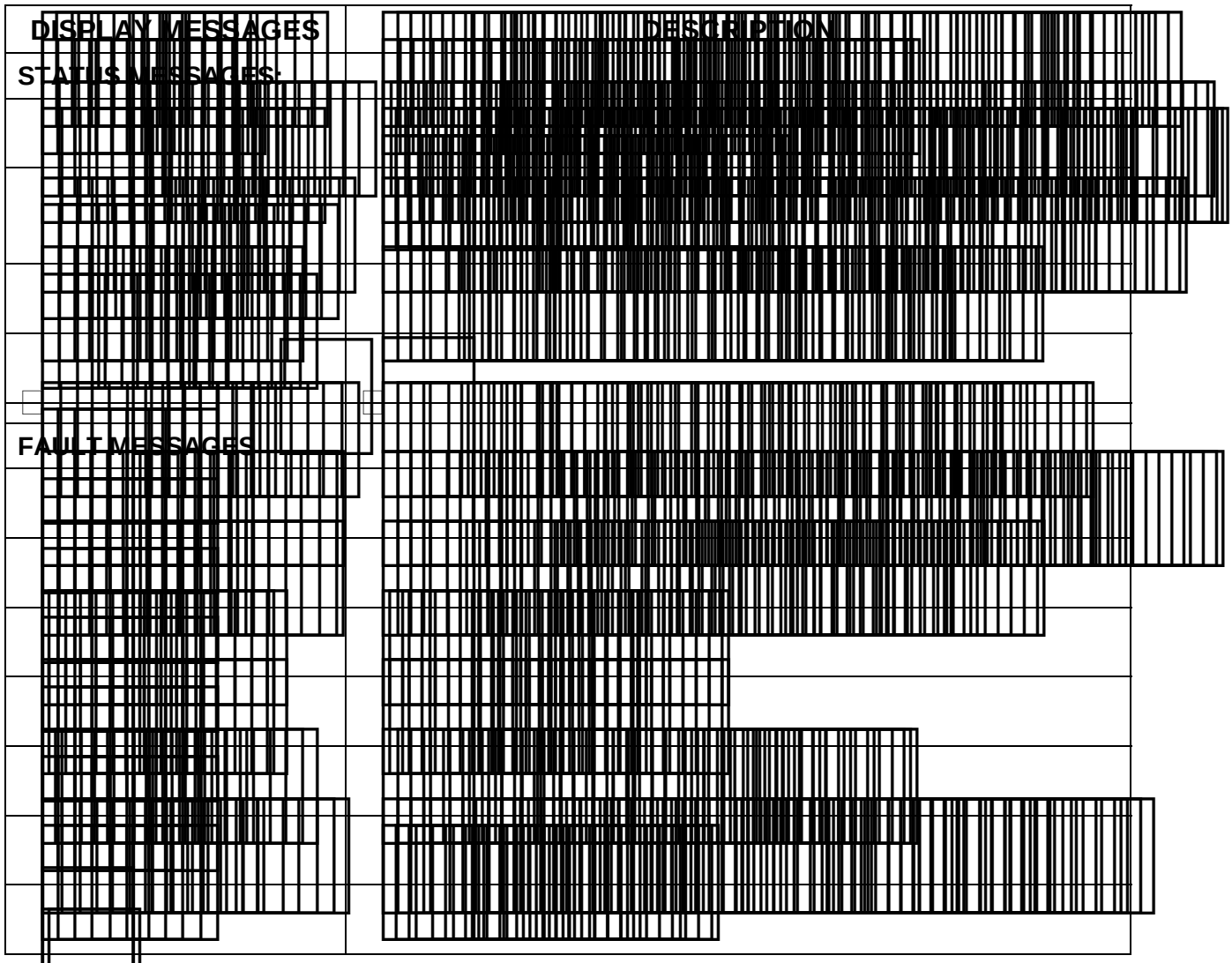
APPENDIX A

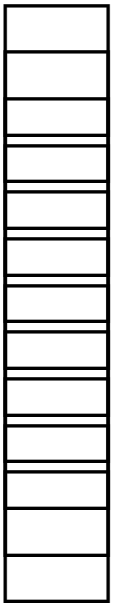
BMS II MENUS - Continued



APPENDIX B

STATUS AND FAULT MESSAGES

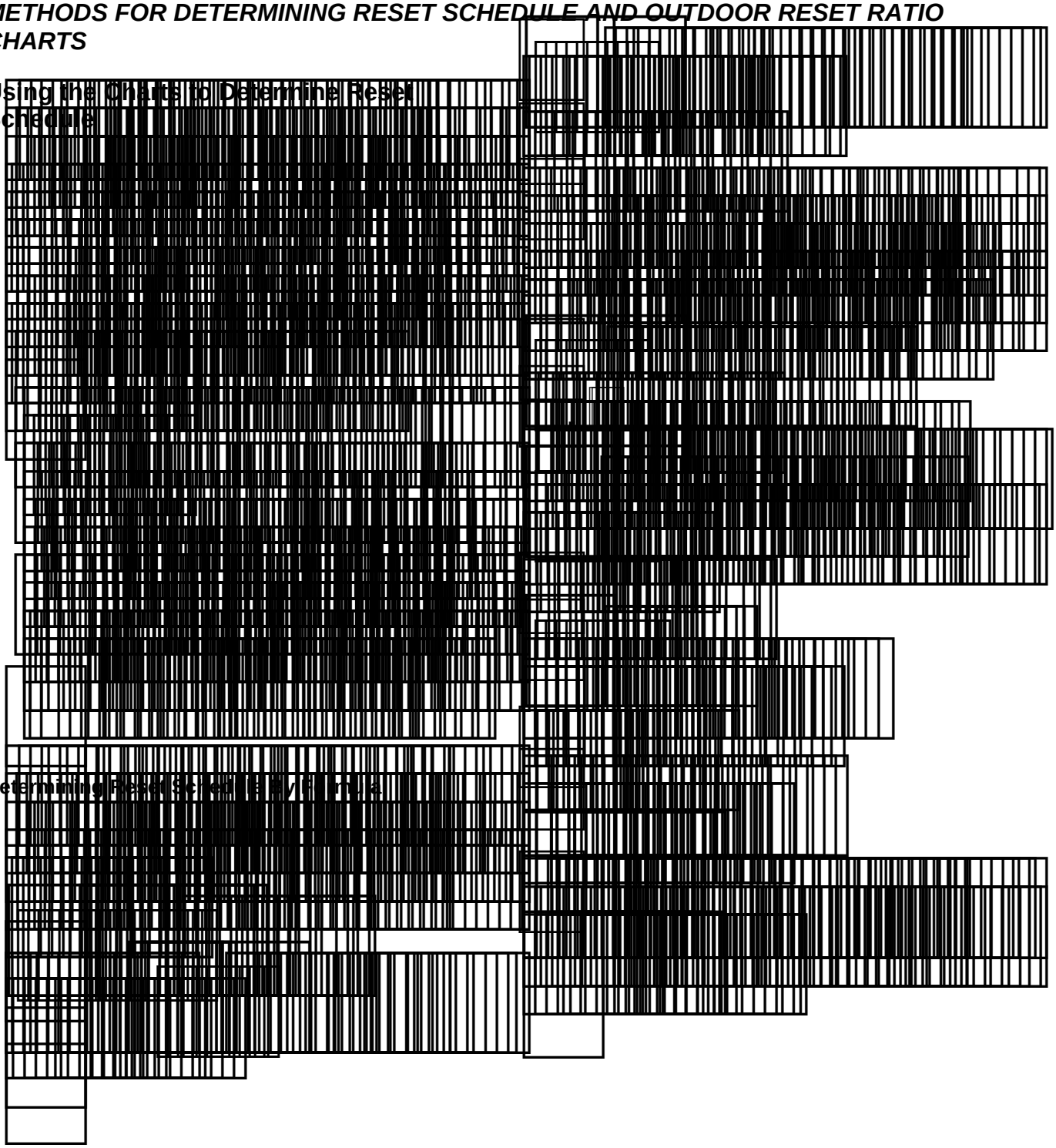




APPENDIX C

METHODS FOR DETERMINING RESET SCHEDULE AND OUTDOOR RESET RATIO CHARTS

Using the Charts to Determine Reset Schedule



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-
-

Determining Reset Schedule by Formula

APPENDIX C

Table C-1. Header Temperature for a Building Reference Temperature of 50°F

Air Temp	RESET RATIO 0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
50°F										
45°F										
40°F										
35°F										
30°F										
25°F										
20°F										
15°F										
10°F										
5°F										
0°F										
-5°F										
-10°F										
-15°F										
-20°F										

Table C-2. Header Temperature for a Building Reference Temperatrure of 60°F

Air Temp	RESET RATIO 0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
60°F										
55°F										
50°F										
45°F										
40°F										
35°F										
30°F										
25°F										
20°F										
15°F										
10°F										
5°F										
0°F										
-5°F										
-10°F										
-15°F										
-20°F										

APPENDIX C

Table C-3. Header Temperature for a Building Reference Temperature of 65°F

Air Temp	RESET RATIO 0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
65°F										
60°F										
55°F										
50°F										
45°F										
40°F										
35°F										
30°F										
25°F										
20°F										
15°F										
10°F										
5°F										
0°F										
-5°F										
-10°F										
-15°F										
-20°F										

Table C-4. Header Temperature for a Building Reference Temperature of 70°F

Air Temp	RESET RATIO 0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
70°F										
65°F										
60°F										
55°F										
50°F										
45°F										
40°F										
35°F										
30°F										
25°F										
20°F										
15°F										
10°F										
5°F										
0°F										
-5°F										
-10°F										
-15°F										
-20°F										

APPENDIX C

Table C-5. Header Temperature for a Building Reference Temperature of 75°F

Air Temp	RESET RATIO									
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
75°F										
70°F										
65°F										
60°F										
55°F										
50°F										
45°F										
40°F										
35°F										
30°F										
25°F										
20°F										
15°F										
10°F										
5°F										
0°F										
-5°F										
-10°F										
-15°F										

Table C-6. Header Temperature for a Building Reference Temperature of 80°F

Air Temp	RESET RATIO									
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
80°F										
75°F										
70°F										
65°F										
60°F										
55°F										
50°F										
45°F										
40°F										
35°F										
30°F										
25°F										
20°F										
15°F										
10°F										
5°F										
0°F										
-5°F										
-10°F										

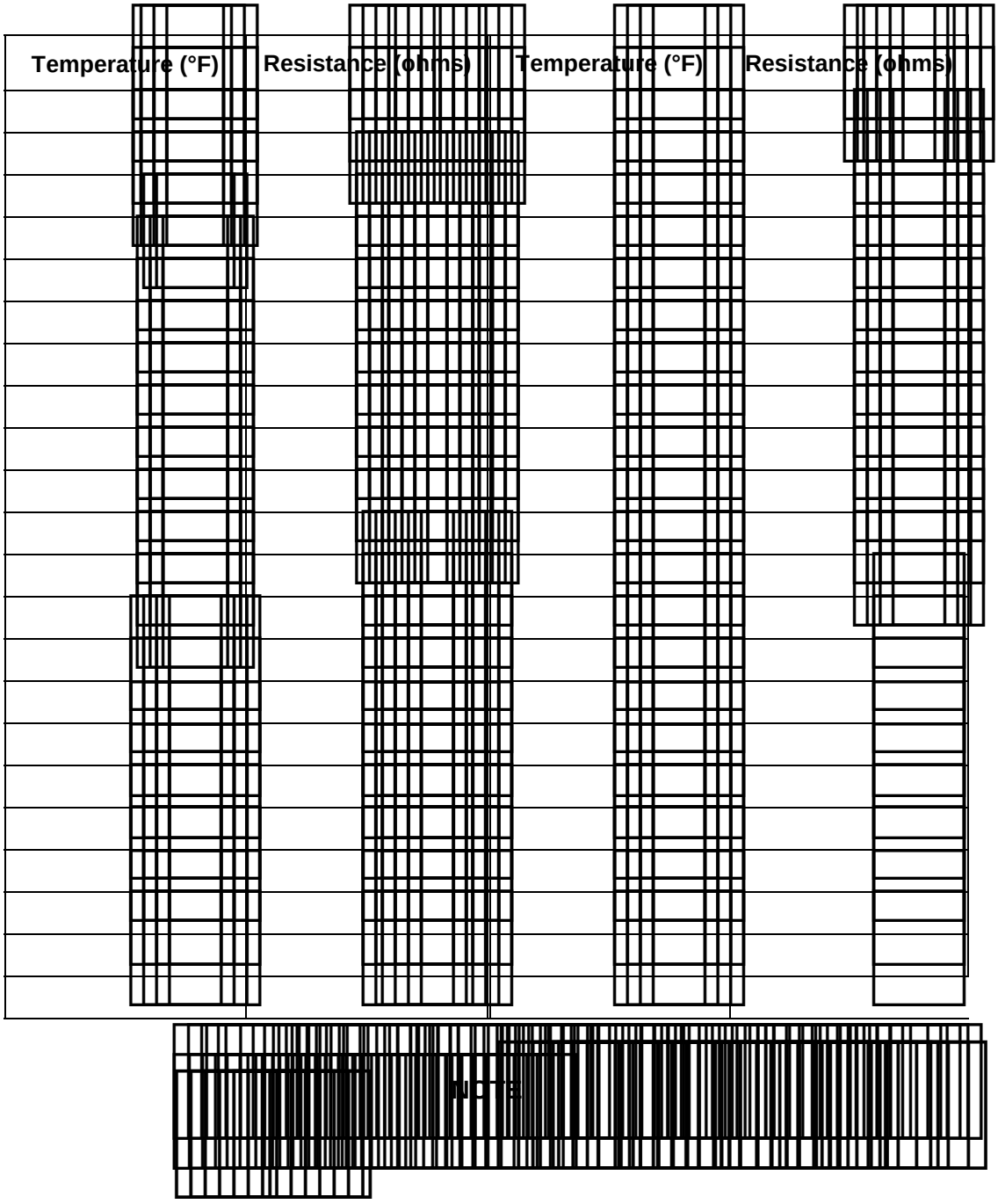
APPENDIX C

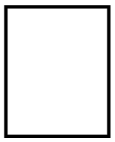
Table C-7. Header Temperature for a Building Reference Temperature of 90°F

Air Temp	RESET RATIO									
	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
90°F										
85°F										
80°F										
75°F										
70°F										
65°F										
60°F										
55°F										
50°F										
45°F										
40°F										
35°F										
30°F										
25°F										
20°F										
15°F										
10°F										
5°F										
0°F										

APPENDIX D

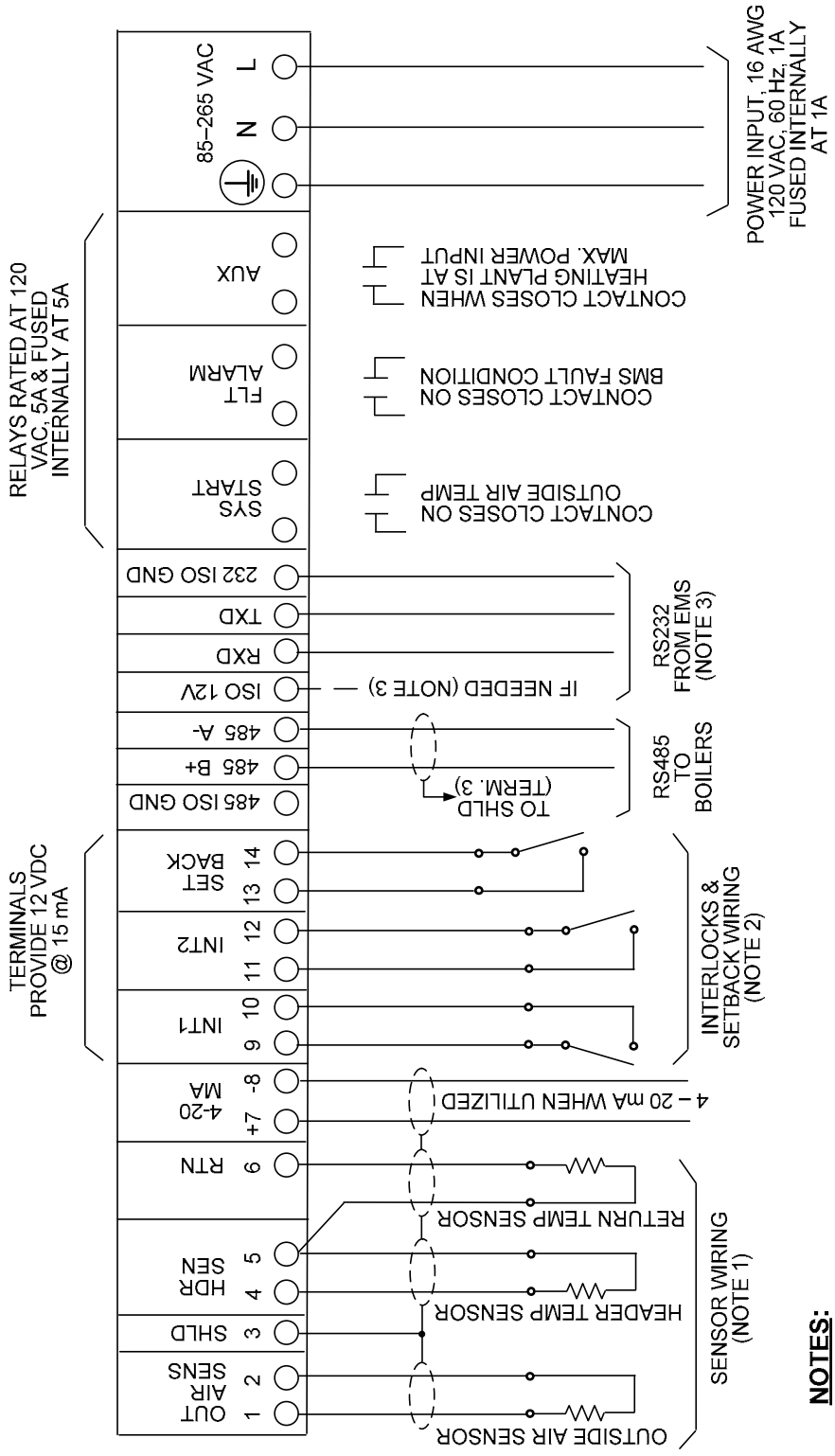
NTC Temperature Sensor Resistance Chart





APPENDIX E

BMS II WIRING DIAGRAM

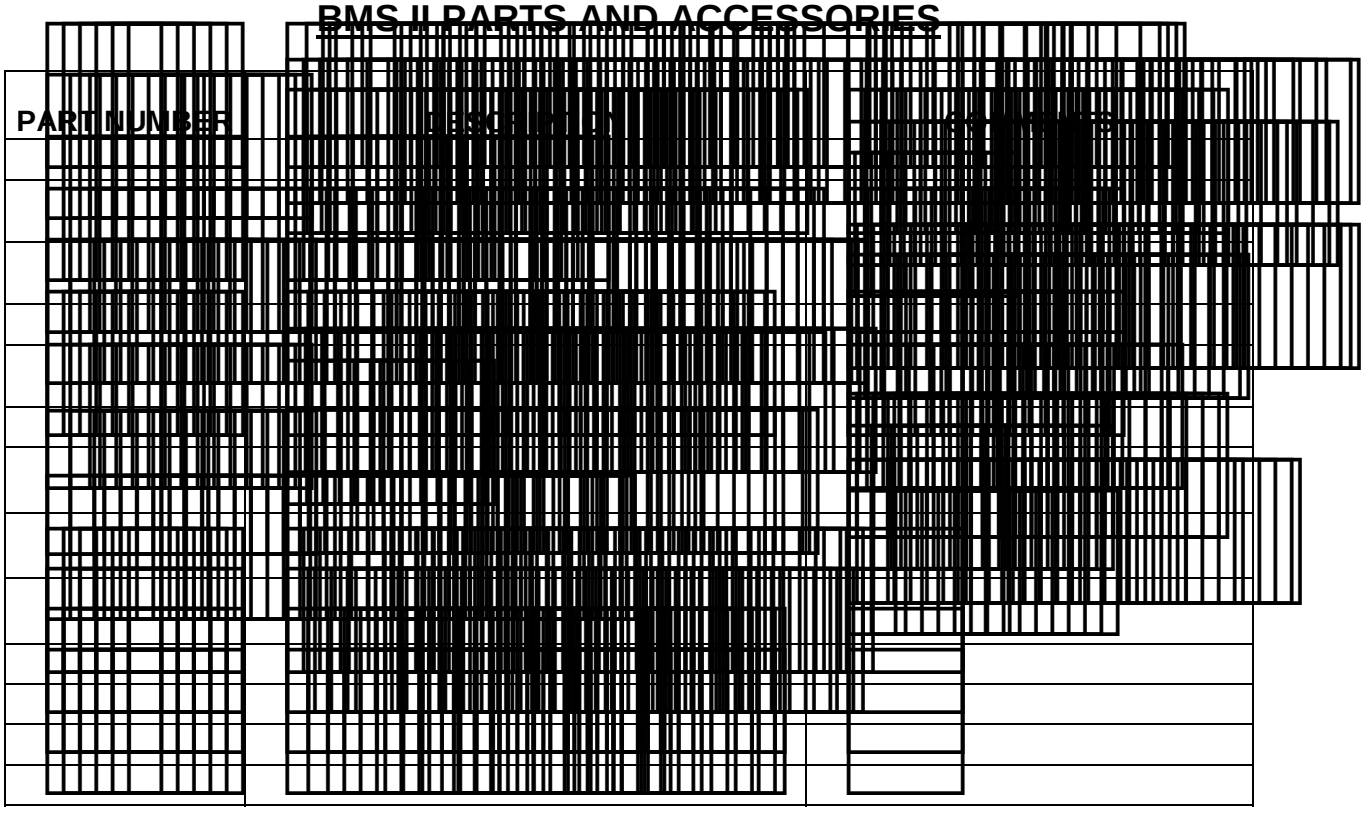


NOTES:

1. AERCO RECOMMENDS USING TWO-CONDUCTOR, TWISTED, SHIELDED PAIR , 22 AWG CABLE (BELDEN 9841 OR EQUIV.)
   - TERMINATE SHIELDS AT BMS SHIELD (SHLD) TERMINAL ONLY.
   - DO NOT CONNECT SHIELDS AT SENSOR ENDS.
   - DO NOT RUN SENSOR WIRING WITH POWER WIRING.
2. CONTACTS PROVIDED BY OTHERS. USE CONTACTS RATED FOR LOW SIGNAL LEVELS.
   JUMPER INTERLOCKS (INT1, INT2) IF EXTERNAL CONTACTS ARE NOT USED.
3. IF THE EMS BEING USED CONTAINS ONLY A RS485 PORT, A RS485-TO-RS232 CONVERTER IS REQUIRED. IF NECESSARY, A 12 VDC OUTPUT IS PROVIDED BY THE BMS II TO POWER THE RS485-TO-RS232 CONVERTER,

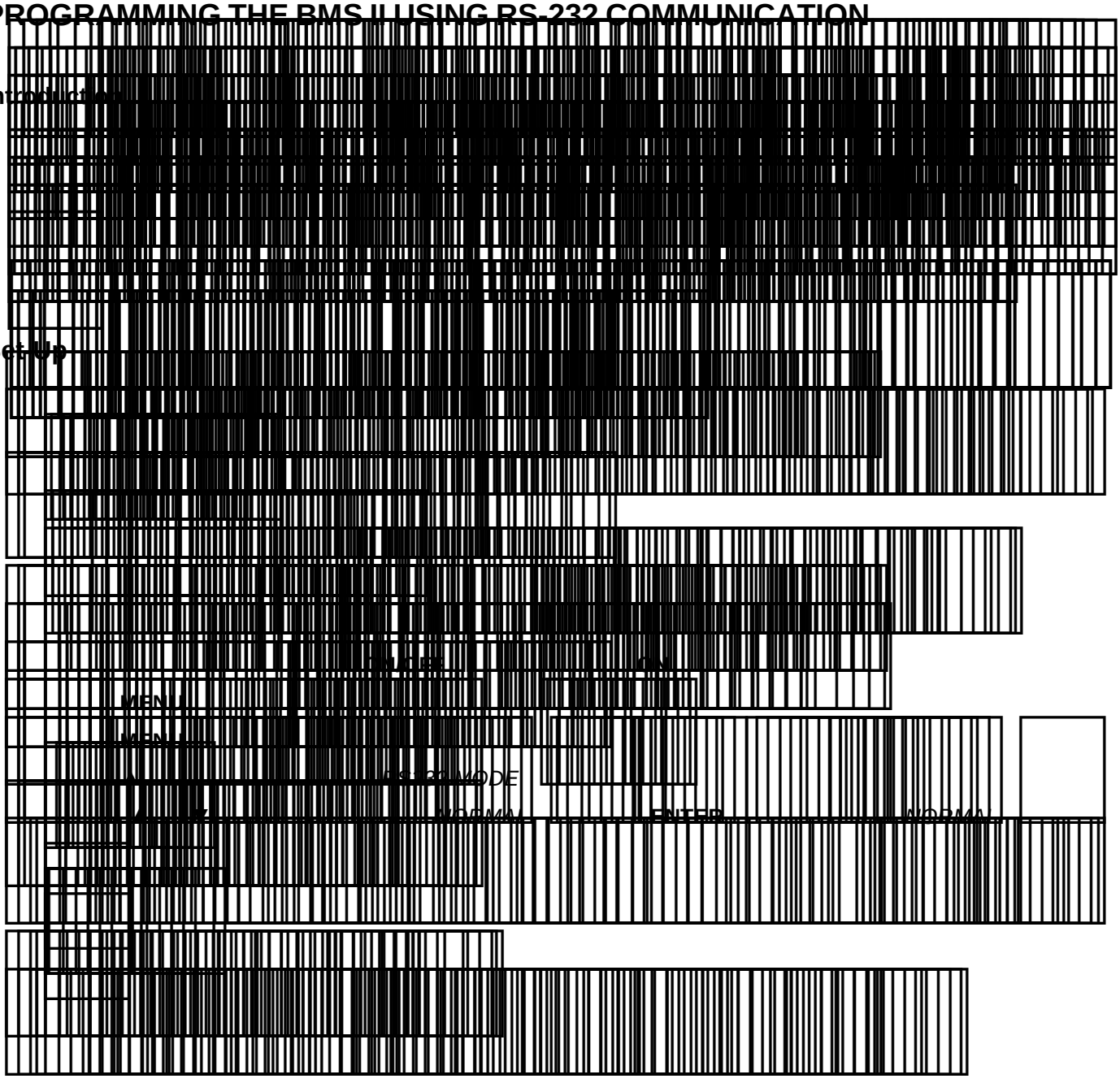
APPENDIX F

BMS II PARTS AND ACCESSORIES



APPENDIX G

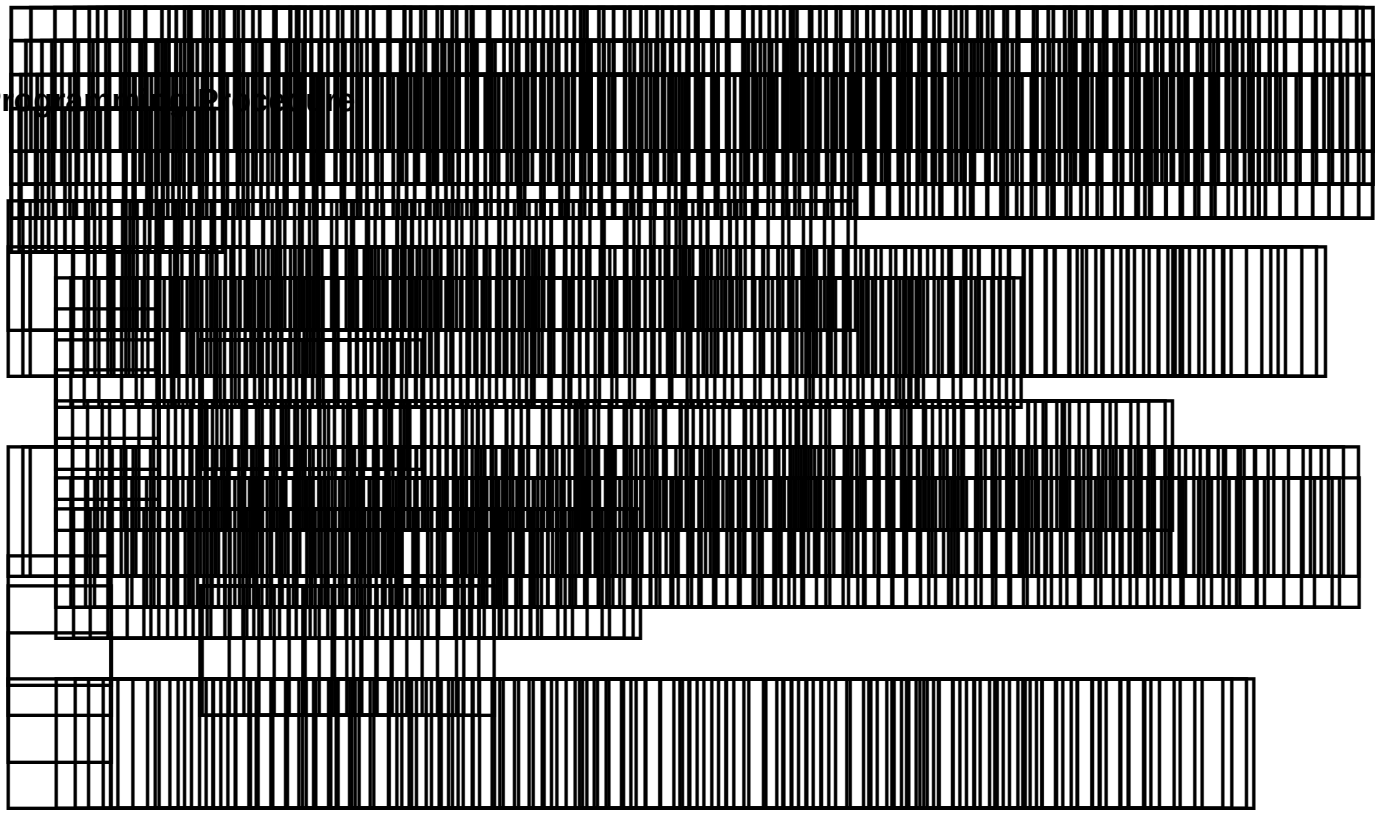
PROGRAMMING THE BMS II USING RS-232 COMMUNICATION



Introduction

Set Up

APPENDIX G (cont.)



APPENDIX G (cont.)

Table G-1. BMS II COMMANDS

No.	[illegible]	ENTRY RANGE	FACTORY DEFAULT

APPENDIX G (cont.)

Table G-1. BMS II COMMANDS

No.	COMMAND	ENTRY RANGE	FACTORY DEFAULT

APPENDIX G (cont.)

Table G-1. BMS COMMANDS (Continued)

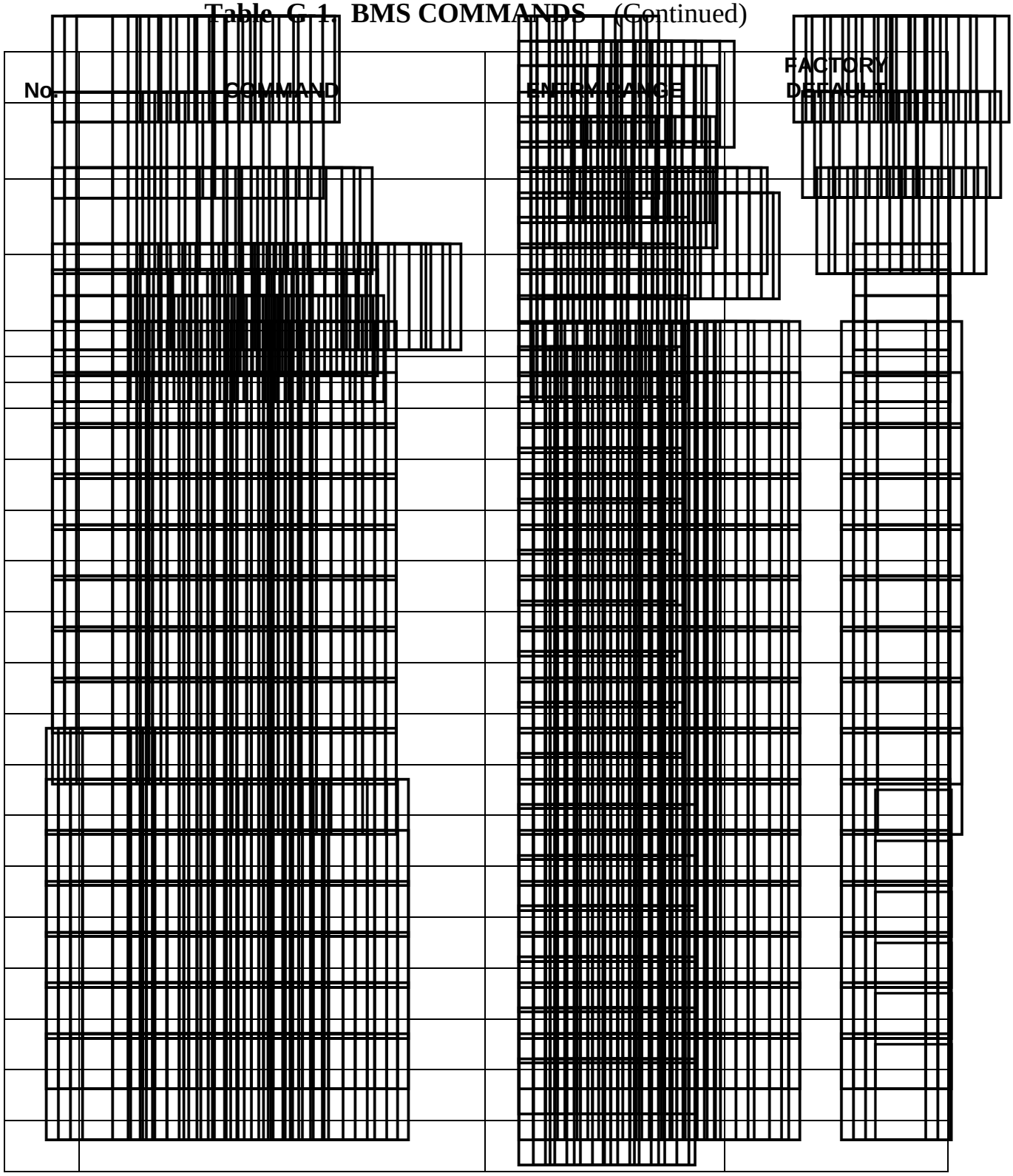
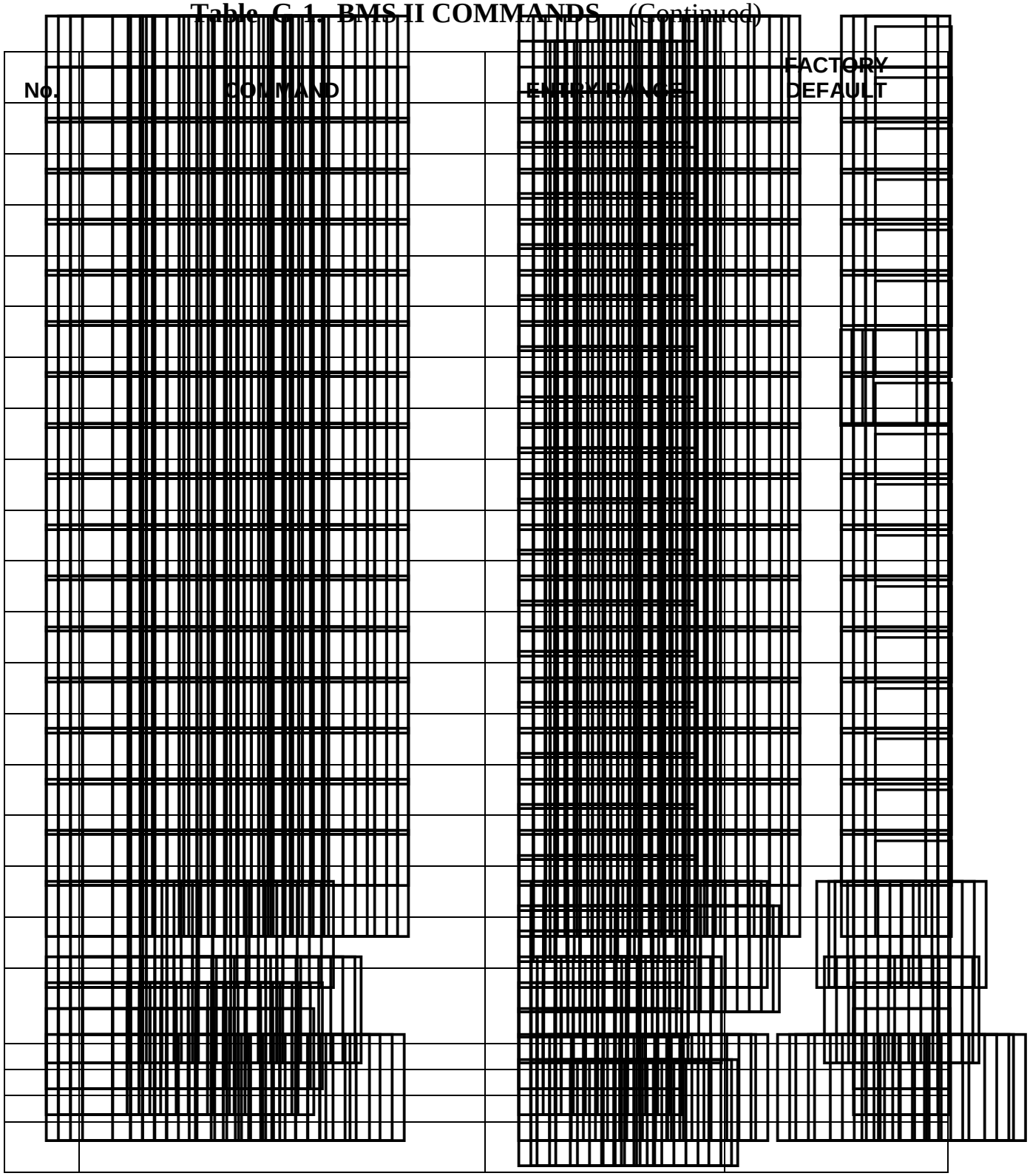


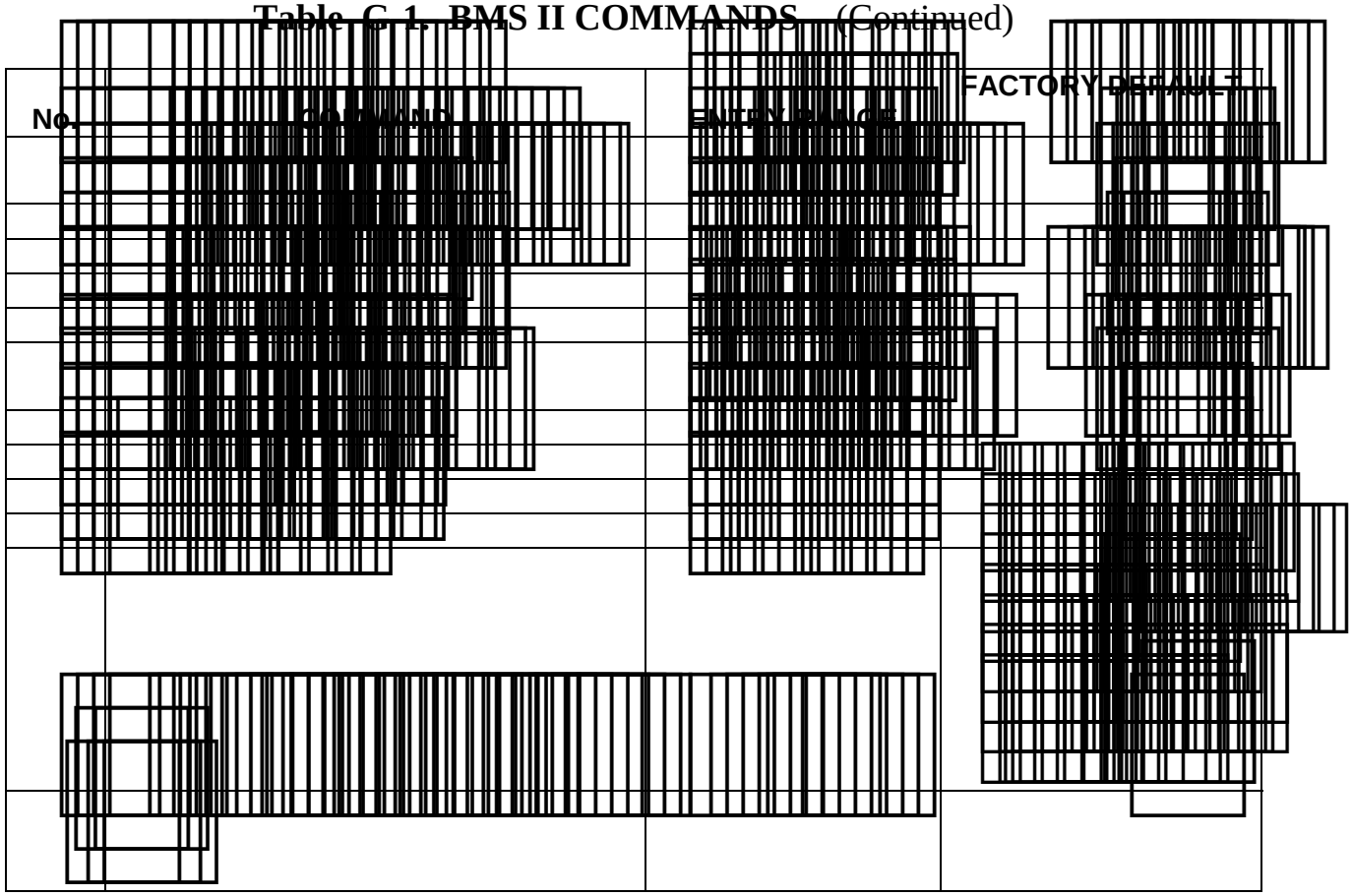
Table G-1. BMS II COMMANDS (Continued)



No.	COMMAND	ENTRY RANGE	FACTORY DEFAULT

APPENDIX G (cont.)

Table G-1. BMS II COMMANDS (Continued)



APPENDIX H

BMS II MODBUS ADDRESS ASSIGNMENTS

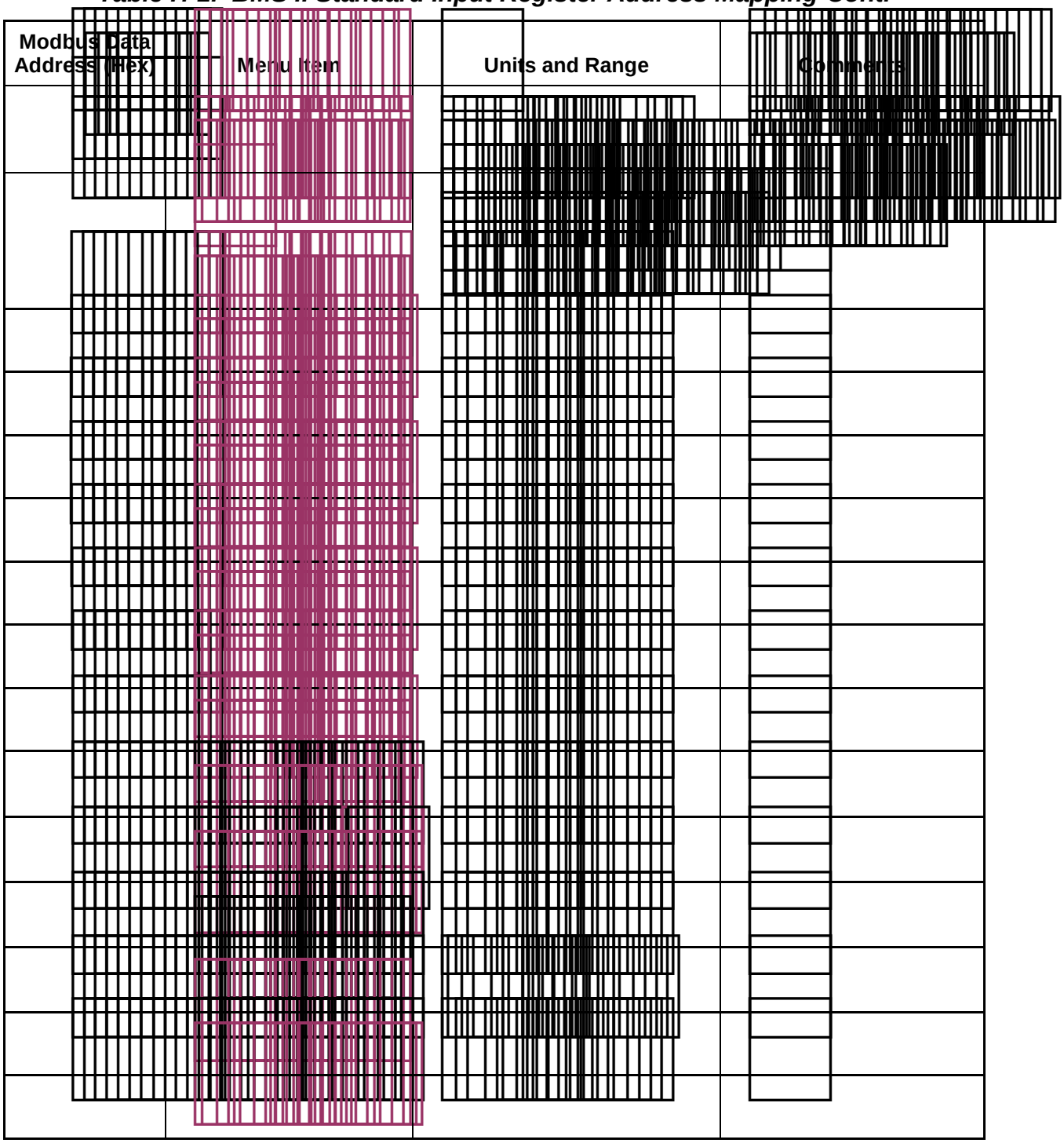
H-1 BMS II STANDARD INPUT REGISTER ASSIGNMENTS

Table H-1. BMS II Standard Input Register Address Mapping

Modbus Data Address (Hex)	Menu Item	Units and Range	Default/Comments

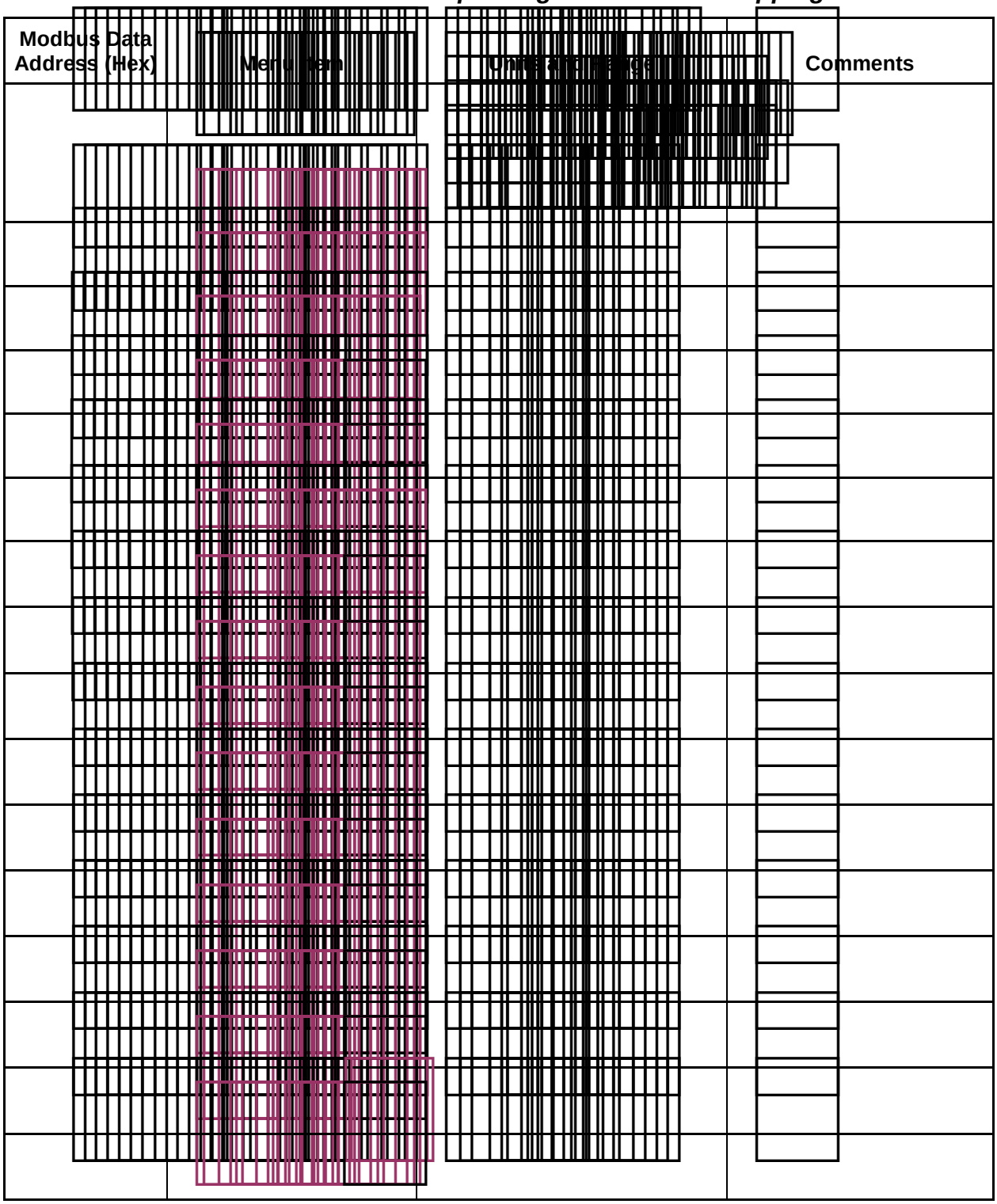
APPENDIX H (cont.)

Table H-1. BMS II Standard Input Register Address Mapping-Cont.



APPENDIX H (cont.)

Table H-1. BMS II Standard Input Register Address Mapping-Cont.



APPENDIX H

APPENDIX H (cont.)

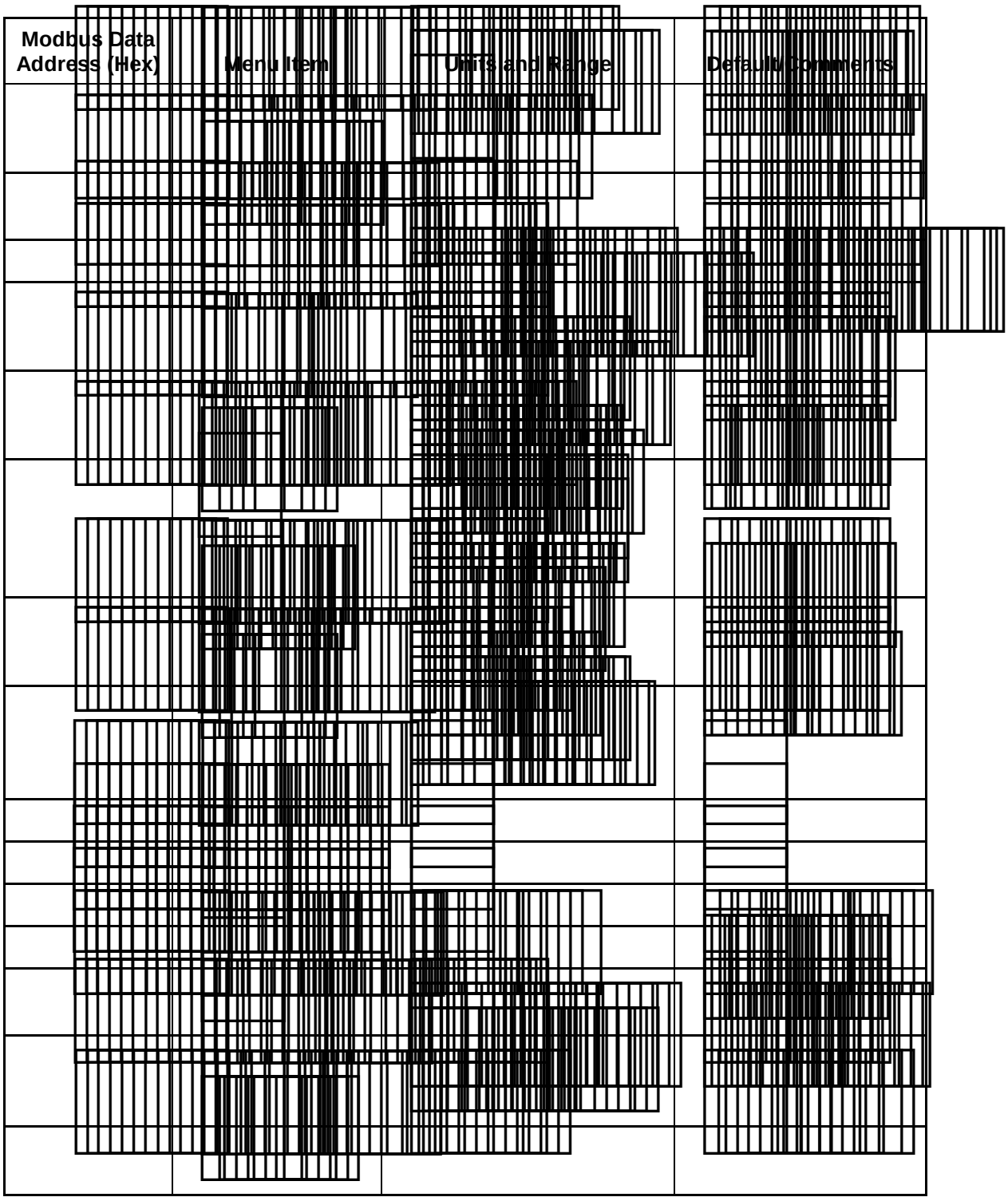
H-2. BMS II Controller Standard Holding Register Assignments

Table H-2. BMS II Standard Holding Register Address Mapping

Modbus Data Address (Hex)	Menu Item	Units and Range	Default/Comments

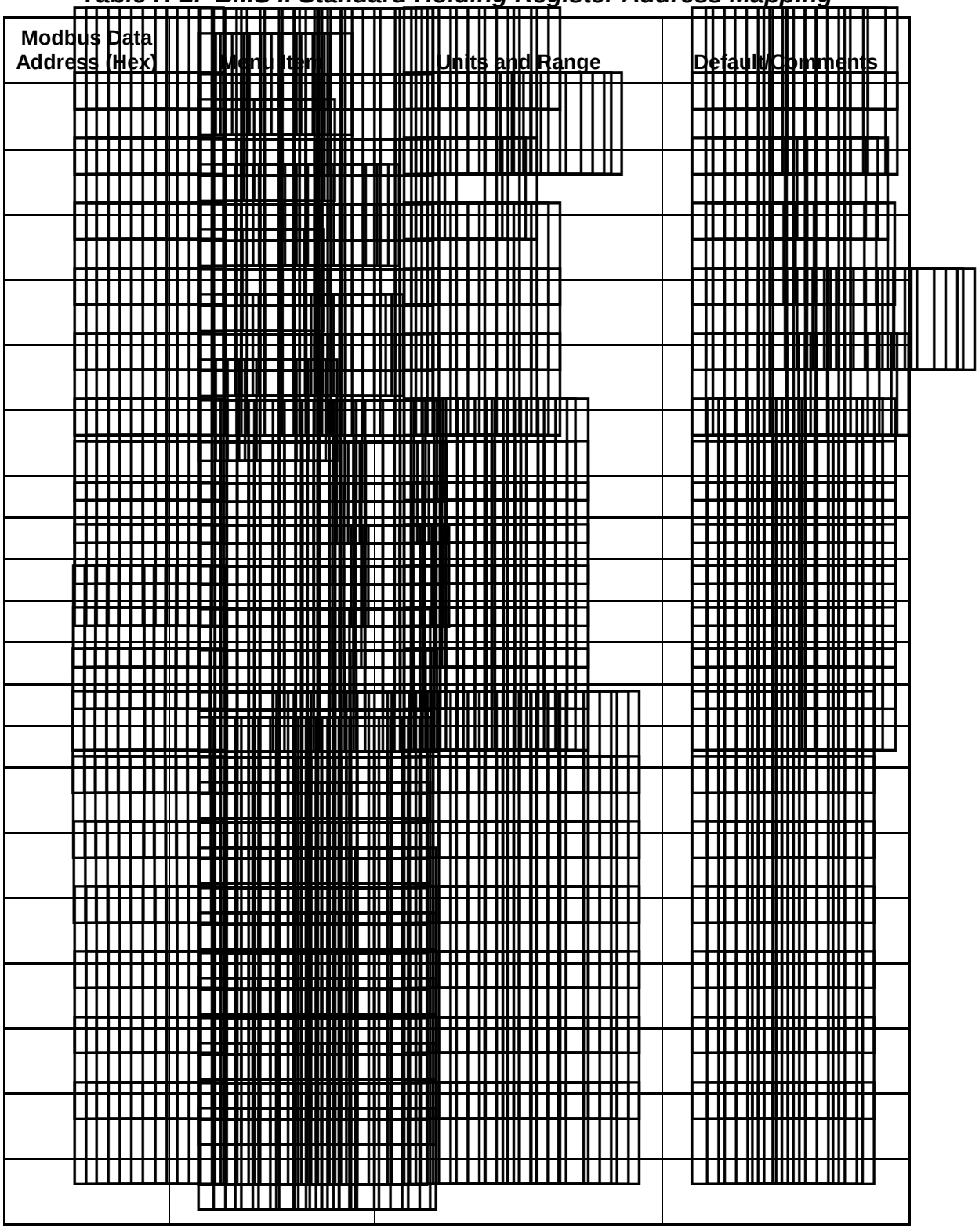
APPENDIX H (cont.)

Table H-2. BMS II Standard Holding Register Address Mapping



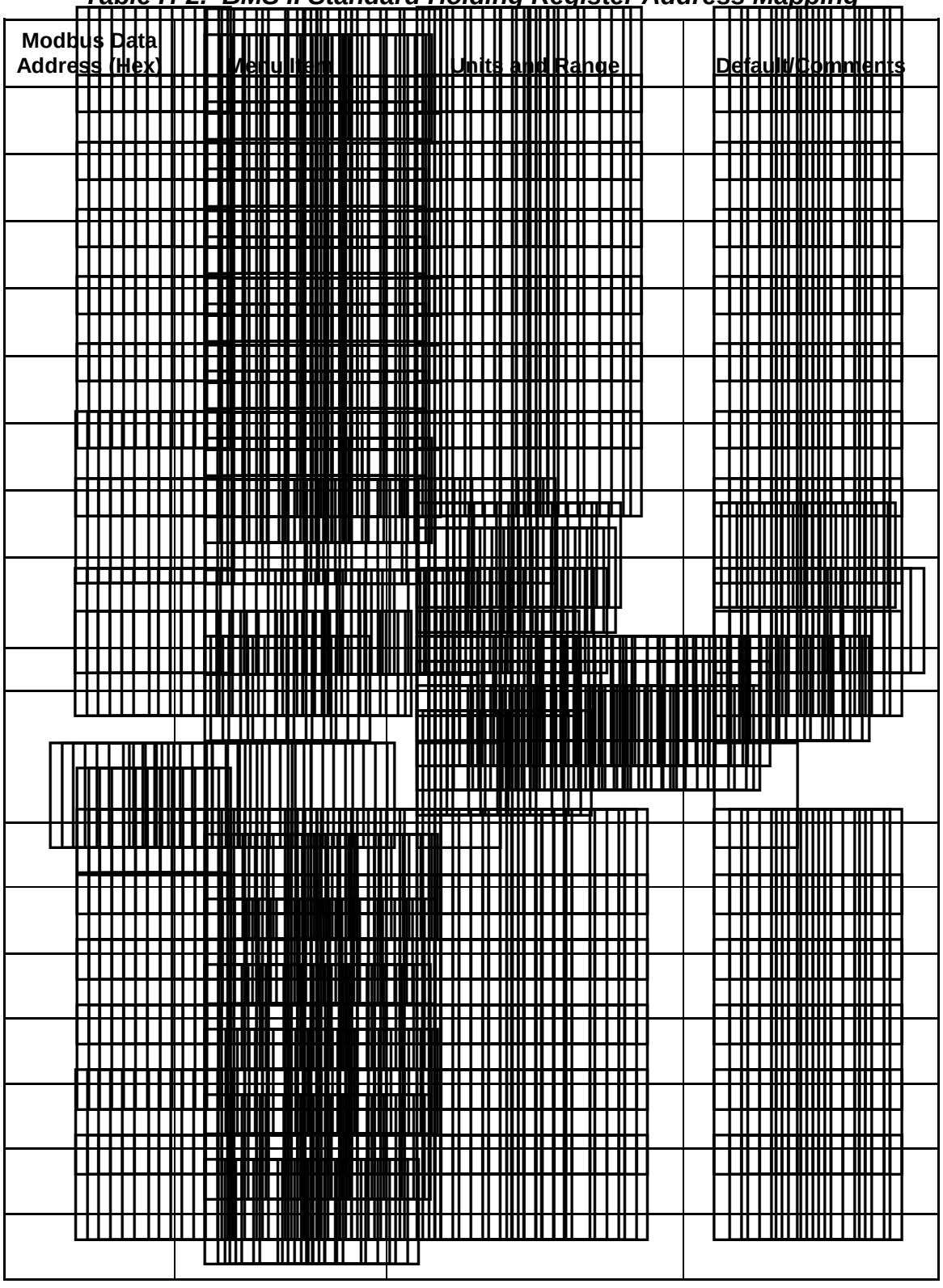
APPENDIX H (cont.)

Table H-2. BMS II Standard Holding Register Address Mapping



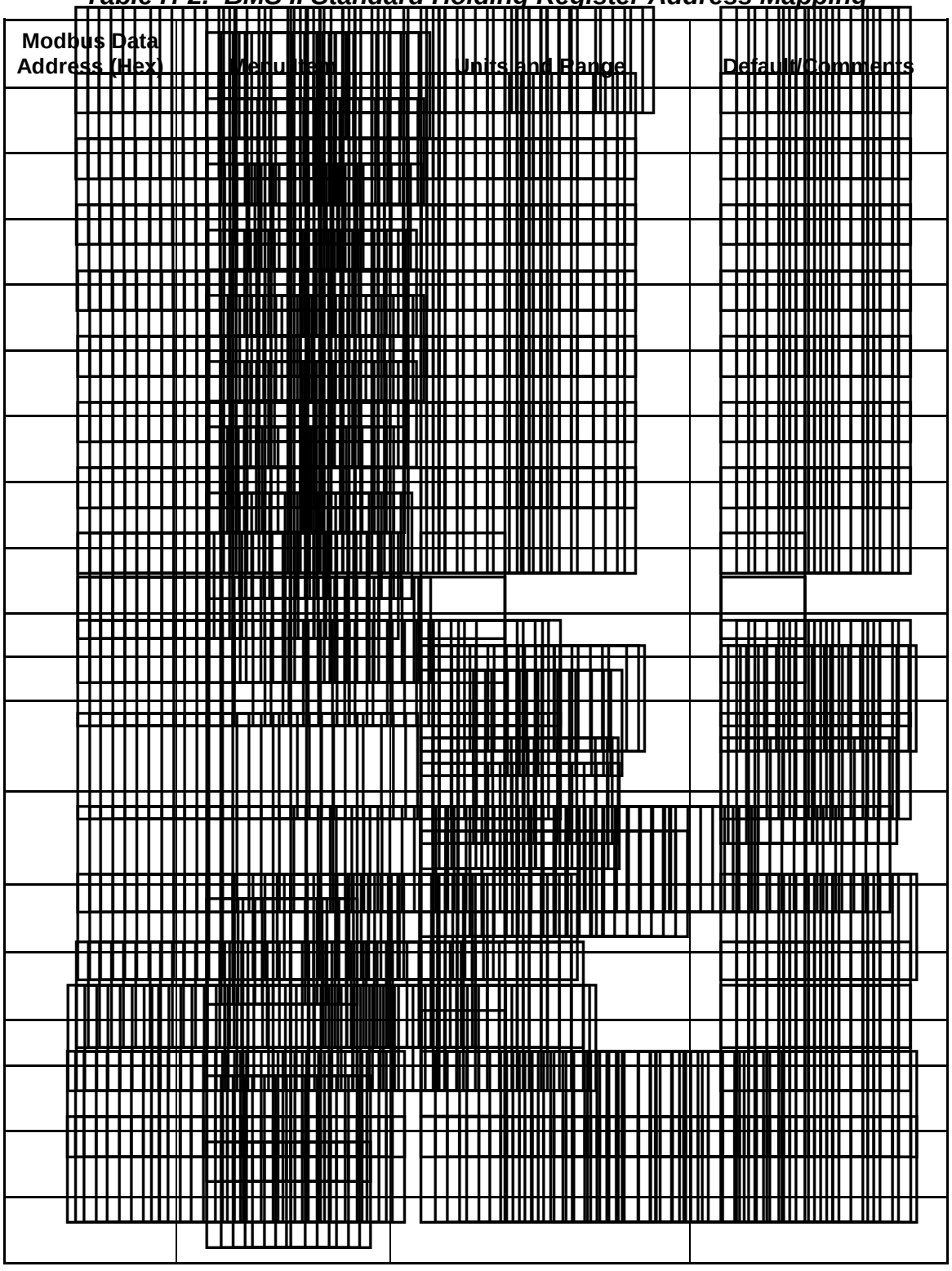
APPENDIX H (cont.)

Table H-2. BMS II Standard Holding Register Address Mapping



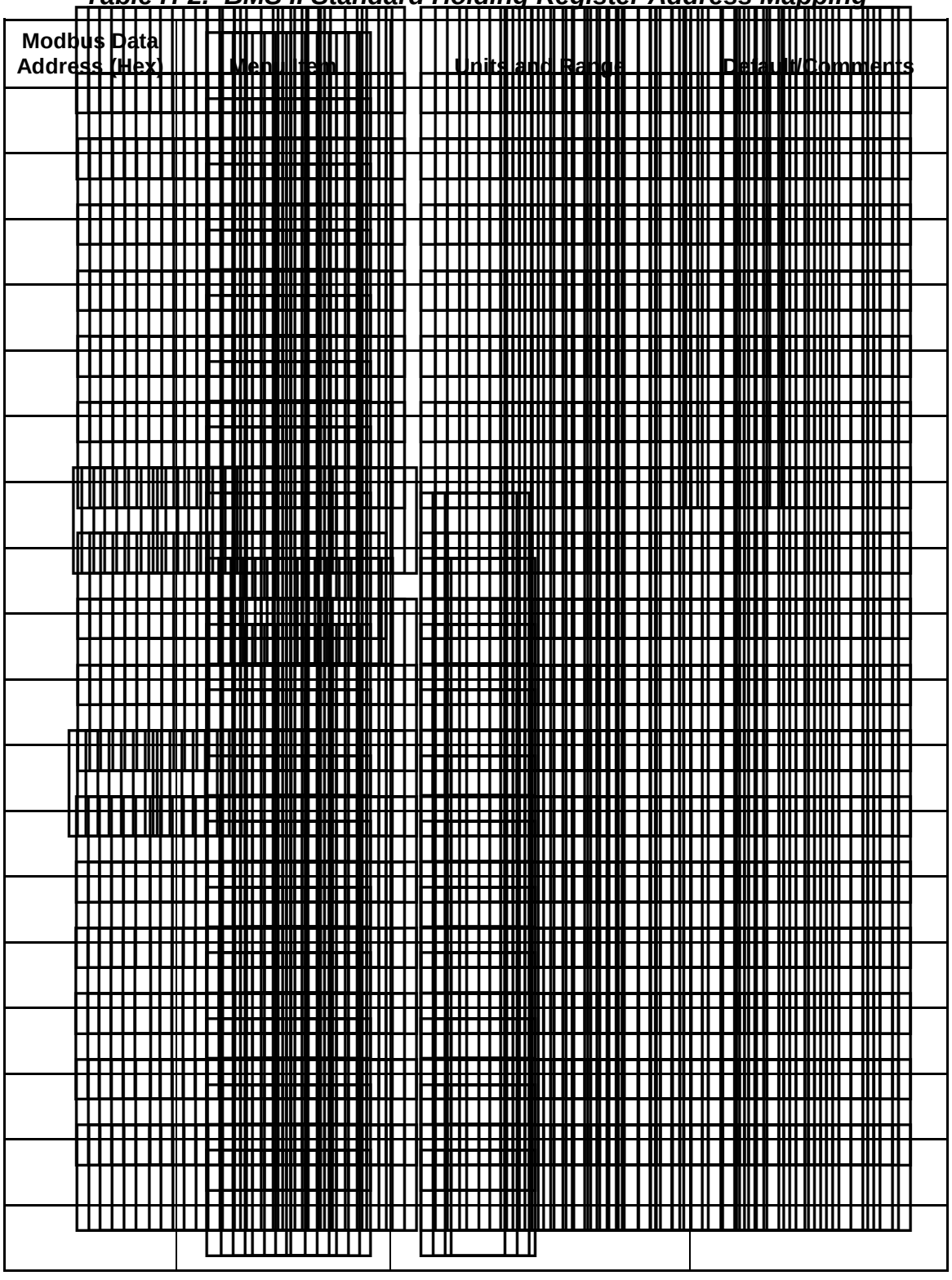
APPENDIX H (cont.)

Table H-2. BMS II Standard Holding Register Address Mapping



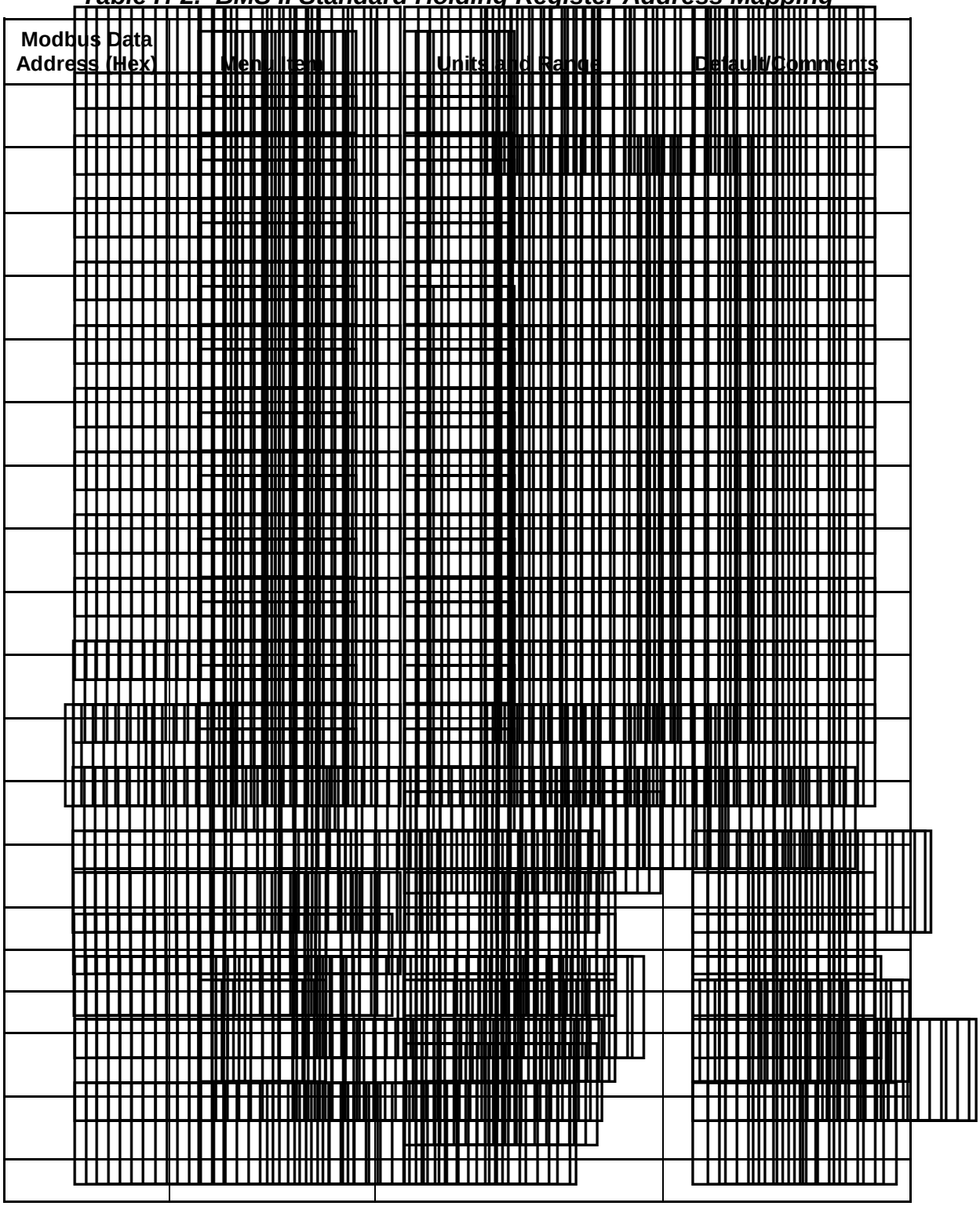
APPENDIX H (cont.)

Table H-2. BMS II Standard Holding Register Address Mapping



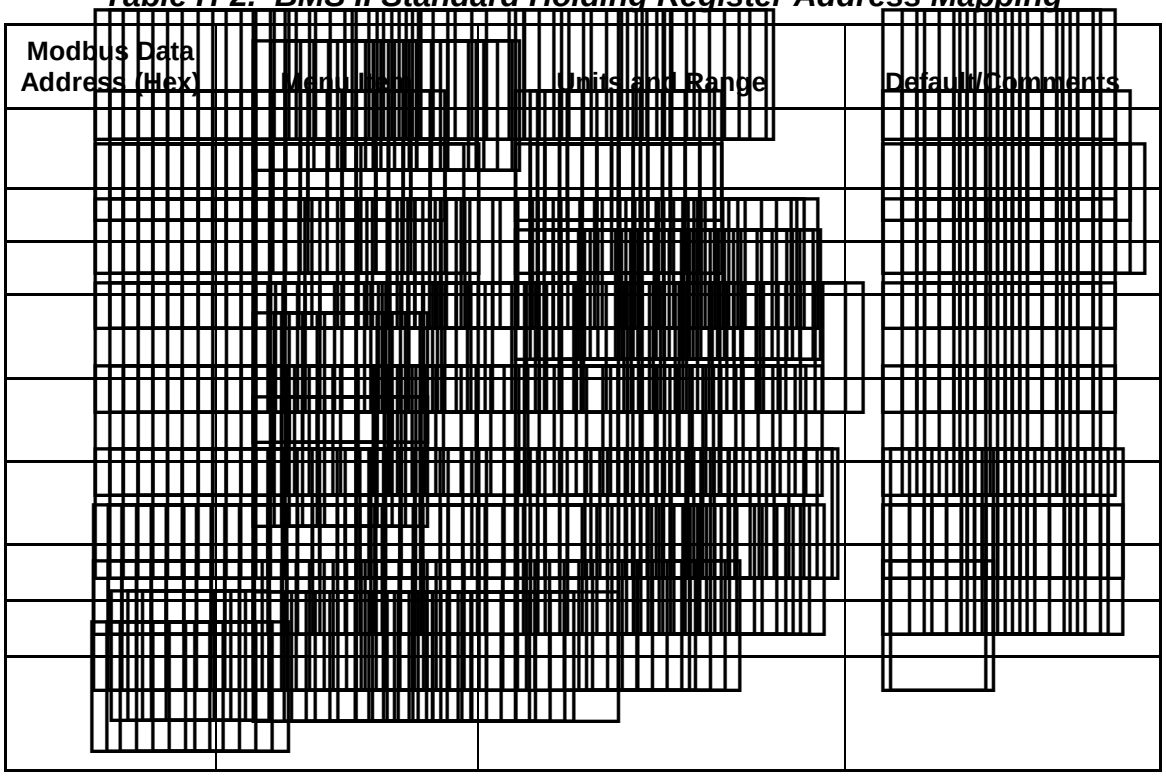
APPENDIX H (cont.)

Table H-2. BMS II Standard Holding Register Address Mapping



APPENDIX H (cont.)

Table H-2. BMS II Standard Holding Register Address Mapping



APPENDIX I

BOILER START AND BOILER STOP LEVELS

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MODULEX BOILER START/STOP LEVELS

MODULEX MODEL	NUMBER OF MODULES	START LEVEL	STOP LEVEL

-
-
-