Technical Manual

TRAINING

Qualified maintenance personnel using a scheduled maintenance program are the best way to minimize machine downtime and maximize productivity of equipment.

Marion offers factory and mine site maintenance seminars and special familiarization programs for mechanics, oilers, electricians and operators on a fee basis.

These programs are presented by qualified factory specialists and service technicians. Special customized training programs can also be developed to meet specific mine requirements.

Objectives of training and training materials are to provide the means for developing and maintaining on-site service repair capability.

For further information about Marion service training capabilities and programs contact:

Training Supervisor
Marion Division of INDRESCO Inc.
617 West Center St.
P.O.Box 505
Marion, OH 43302

PROTOCOL:

1. Turn the CPU selector switches to the STOP and WRITE positions. Put the Workmaster (W/M) in the OFF LINE MODE.

2. Clear the Workmaster (W/M) memory. The surest way to do this is to turn the W/M off and reboot the Logicmaster system. Another way is to select the F6 L/S/V Function Key from the Supervisor Menu and use the F5 CLEAR Function Key.

3. From the Supervisor Menu, select the SCRATCH PAD display and set the correct parameters to match the CPU ID number, installed memory size and Register memory size. (Use the SELECT key to get to the numeric or bottom field in the lower right of the display screen.) See example below.

4. Use 01 for CPU ID default, if not otherwise identified. Logic and register memory size must be correct, else the installation of the "blank" program may clear only part of the memory.

5. Select the F6 L/S/V Function Key from the Supervisor Menu and implement the standard STORE procedure.

7. Return to the Supervisor Menu, select F6 L/S/V Function Key from the Supervisor Menu and implement the standard STORE procedure for the desired real program.

8. Following storage of the operating program, return to the SCRATCH PAD display. Turn the CPU switches to RUN and PROTECT. Depress the ENABLE function key when prepared to power up the operating system.

SCRATCH PAD DISPLAY EXAMPLE:

CPU ID NUMBER:	1	WORDS USED:	18
MEMORY SIZE:	16K	WORDS AVAILABLE:	16,366
SUBROUTINES USED:	00	REGISTERS:	8,192
FUNCTIONS:	XPANDED		

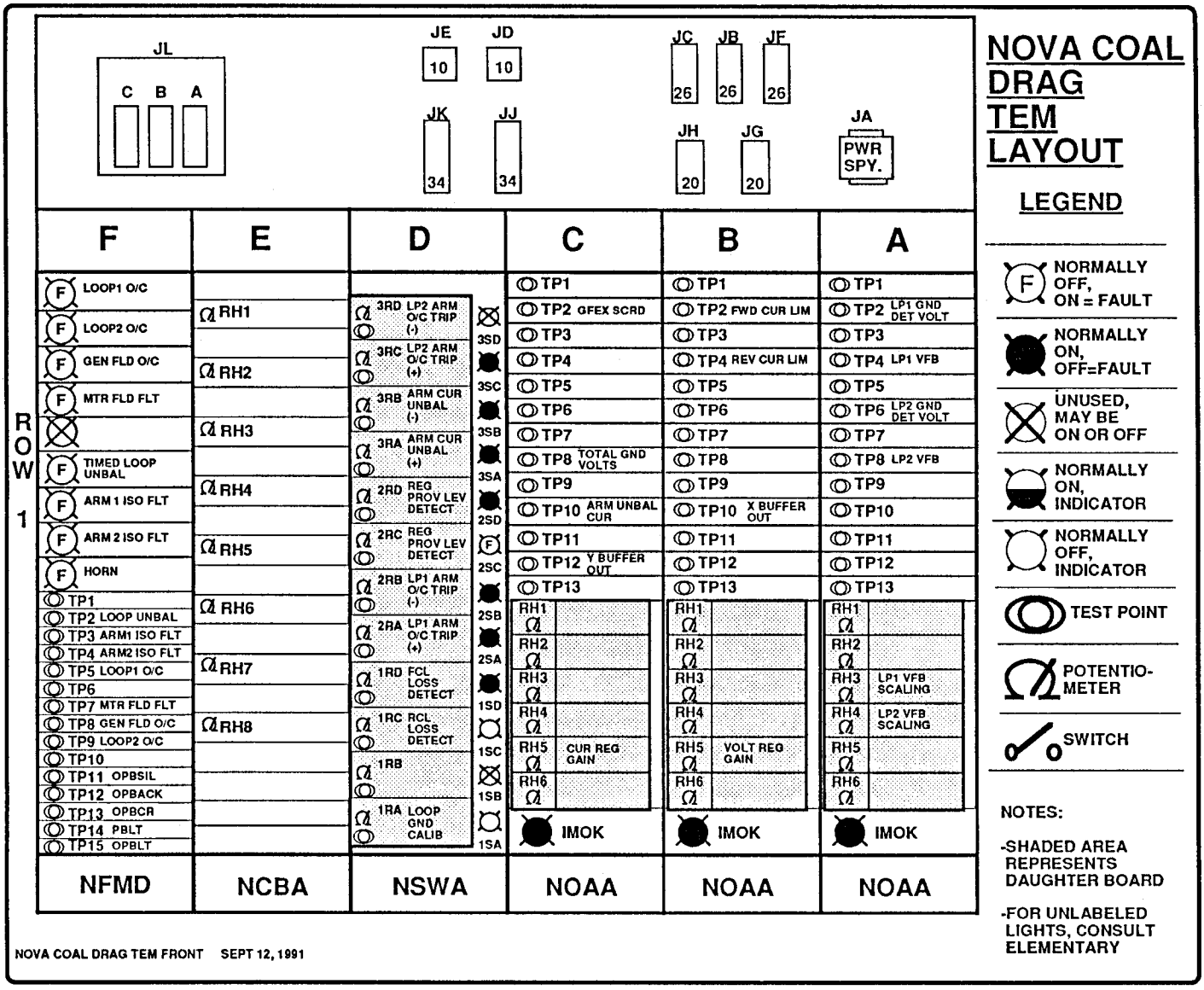
Setup Parameters Worksheet

NovaCoal 7820 Dragline (K-78213)
Setpoints adjusted with the OIT

Subject: General Parameters

Setpoint Values:	Registers	Typical Setting	Units	Value Max	Value Min	Display Type
1 Low Air Pressure Trip Alarm	R -3501	90.0	PSI	150.0	50.0	NN.N
2 Allowed Time for Soft Start	R -3502	200	Sec	300	20	Int.
3 Time Delay for Momentary U/V	R -3503	2.0	Sec	5.0	0.5	N.N
4 Time Delay for Sustained U/V	R -3504	4.0	Sec	8.0	1.0	N.N
5 Time Delay for OverVoltage	R -3505	2.0	Sec	4.0	1.0	N.N
6 Momentary U/V Trip Voltage	R -3506	5900	Volts	6600	5000	Int.
7 Sustained U/V Trip Voltage	R -3507	5600	Volts	6600	5000	Int.
8 Overvoltage Trip Voltage	R -3508	7260	Volts	7500	6000	Int.
9 Time Delay For Encoder Error	R -3509	20	Sec.	40	10	Int.
10 Sync Motor Min. Field	R -3510	85	Amps.	100	10	Int.
11 Spare	R -3511					
12 Spare	R -3512					
13 Spare	R -3513					
14 Spare	R -3514					
15 Spare	R -3515					
16 Spare	R -3516					

Monitoring Values:	Registers	Units	Scaled Value	Display Type
17 Line Amps	R -2351	Amps	8V = 600 A	Int.
18 Line Watts Feedback	R -2352	KWatts	8V = 5000 KW	Int.
19 Line Vars Feedback	R -2353	KVars	8V = 5000 KVAR	Int.
20 Air Pressure	R -2354	PSI	5.5V= 300 PSI	NN.N
21 Sync. Field/S.S. PCM VFB	R -2356	Volts	8V = 500 V	NN.N
22 Sync. Field/S.S. PCM CFB	R -2357	Amps	8V=300A Run,1000A Start	Int.
23 Machine Voltage	R -2358	Volts	8V = 6600 V	Int.
24 Sync. Motor Volts	R -2359	Volts	8V = 6600 V	Int.
25 Power Conv. Module Ref.	R -2390	Amps	8V = 300 A (Nor 8V = 1000 A (Soft Start)	Int.



NOVA COAL DRAG TEM LAYOUT

LEGEND

- F — NORMALLY OFF, ON = FAULT
- NORMALLY ON, OFF=FAULT
- UNUSED, MAY BE ON OR OFF
- NORMALLY ON, INDICATOR
- NORMALLY OFF, INDICATOR
- TEST POINT
- POTENTIO-METER
- SWITCH

NOTES:

-SHADED AREA REPRESENTS DAUGHTER BOARD

-FOR UNLABELED LIGHTS, CONSULT ELEMENTARY

NOVA COAL DRAG TEM FRONT SEPT 12, 1991

EVENT CODE TABLE

EVENT CODE #	DESCRIPTION
95	SYNC. MOTOR STATOR OVERTEMPERATURE
96	DRAGLINE CENTER JOURNAL OVERTEMPERATURE
97	HOUSE AMBIENT OVERTEMPERATURE
98	POWER CONTROL ROOM OVERTEMPERATURE
99	PROPEL LEFT OUTBOARD BEARING O'TEMP.
100	PROPEL LEFT INBOARD BEARING O'TEMP.
101	SWING LOWER BEARING #1 OVERTEMPERATURE
102	HOIST DRUM SHAFT LEFT OVERTEMPERATURE
103	DRAG DRUM SHAFT LEFT OVERTEMPERATURE
104	-RTD SPARE-

PAGE NUMBER : 11

ACTIVE EVENTS F1	ENABLE EVENT F2	DISABLE EVENT F3	F4	F5	GOTO PAGE # F6	PREV. PAGE F7	NEXT PAGE F8	HELP F9	MAIN MENU F10

1. Screen Description: Page 11 of the Event Code Table.
2. Screen accessed by F6, F7 or F8 Key of Event Code Table.
3. Function Keys Description:

   F1 Returns to Active Events Screen.

   F2 Enables a specified Event.

   F3 Disables a specified Event

   F6 Displays a specified Page of the Event Code Table.

   F7 Displays Previous Page of the Event Code Table.

   F8 Displays Next Page of the Event Code Table.

   F9 Displays Event Code Table Help Screens.

   F10 Returns to Main Screen.

PROPEL DRIVE SETUP

DESCRIPTION (UNITS)		CURRENT SETPOINT	TYPICAL SETTING	ALLOWABLE MIN.SETPT	ALLOWABLE MAX.SETPT
1 AMPS AT PEAK POWER	(AMPS)	2088	2088	0	2480
2 AMPS AT FORWARD STALL	(AMPS)	3960	3960	SP#1	4000
3 AMPS AT REVERSE STALL	(AMPS)	-3960	-3960	-4000	-SP#1
4 MAX FORWARD REFERENCE (Q1)	(VOLTS)	8.00	8.00	1.00	8.00
5 MAX REVERSE REFERENCE (Q3)	(VOLTS)	-7.25	-7.27	-1.00	-7.27
6 ANGLE FOR TUB LOWERING	(DEGREES)	210	210	180	250
7 ANGLE FOR SHOE LOWERING	(DEGREES)	80	80	60	120
8 ANGLE FOR SHOE RAISING	(DEGREES)	270	270	250	310

SETUP MENU	SELECT SETPT.								MAIN MENU
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10

1. Screen Description: Propel Drive Setup - view and change setpoints for Propel Drive.

2. Screen accessed from Parameter Setup menu by F4 Key.

3. Function Key Description:

   F1 Returns to Parameter Setup Menu.

   F2 Selects a parameter to change and then enter a new setpoint for that parameter.

   F10 Returns to Main Menu.

SWING DRIVE MONITOR

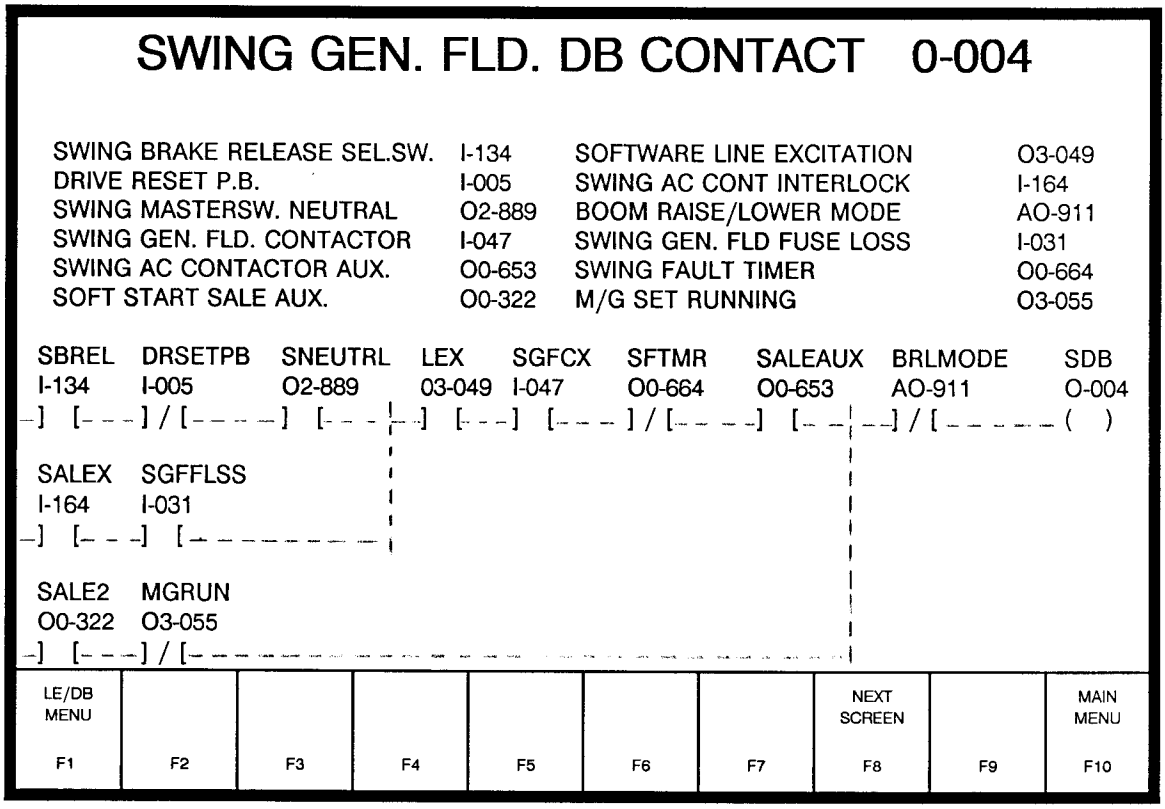
DESCRIPTION (UNITS)		CURRENT VALUE	ANALOG CARD #	CHANNEL#	SCALED VALUES
SWING MASTERSWITCH	(VOLTS)	0.00	GENIUS	R-7027	8V=1638CNT
SWING VOLTAGE FEEDBACK	(VOLTS)	0.7	I-801	8	8V=600V
SWING CURRENT FEEDBACK	(AMPS)	1	I-833	4	8V=2130A
SWING CURRENT REFERENCE	(AMPS)	0	0-897	3	8V=2130A
SWING VOLTAGE REFERENCE	(VOLTS)	600.0	0-929	3	8V=600A

MONIT. MENU									MAIN MENU
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10

1. Screen Description: Swing Drive Monitor.
2. Screen accessed from Analog Monitor Menu.
3. Function Key Description:

   F1 Returns to Analog Monitor Menu.

   F10 Returns to Main Menu.



1. Screen Description: Monitor Swing Generator Field DB Contact.

2. Screen accessed from LE/DB Directory by F4 Key or from 2nd Swing DB Diagnostics Screen by F8 key.

3. Function Key Description:

   F1 Returns to LE/DB Menu.

   F8 Display Next Screen of Swing DB Diagnostics.

   F10 Returns to Main menu.

EVENT CODE TABLE

EVENT CODE #	DESCRIPTION	PAGES
001-038	MECHANICAL/STRUCTURAL MONITORS	2-5
045-104	TEMPERATURE MONITORS	6-11
120-136	AC POWER DISTRIBUTION SYSTEM	12-13
140-146	AC POWER UTILIZATION APPARATUS	14
170-246	DC POWER SYSTEMS	15-22
250-252	ANTI-TIGHTLINE AND PROPEL SYNCHRONIZATION	23
260-291	LOGIC AND CONTROL SYSTEMS	24-27
295-302	SOFT START MONITORS	28

ALL EVENTS THAT ARE HIGHLIGHTED IN YELLOW ARE DISABLED AT THE PRESENT TIME

PAGE NUMBER : 1

ACTIVE EVENTS	ENABLE EVENT	DISABLE EVENT			GOTO PAGE#	PREV. PAGE	NEXT PAGE	HELP	MAIN MENU
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10

1. Screen Description: Event Code Table (Table of Contents) - List all possible Events that can be logged.

2. Screen accessed from Active Events Screen by F2 Key.

3. Function Key Description:

   F1 Returns to Active Events Screen.

   F2 Enables a specified Event.

   F3 Disables a specified Event

   F6 Displays a specified Page of the Event Code Table.

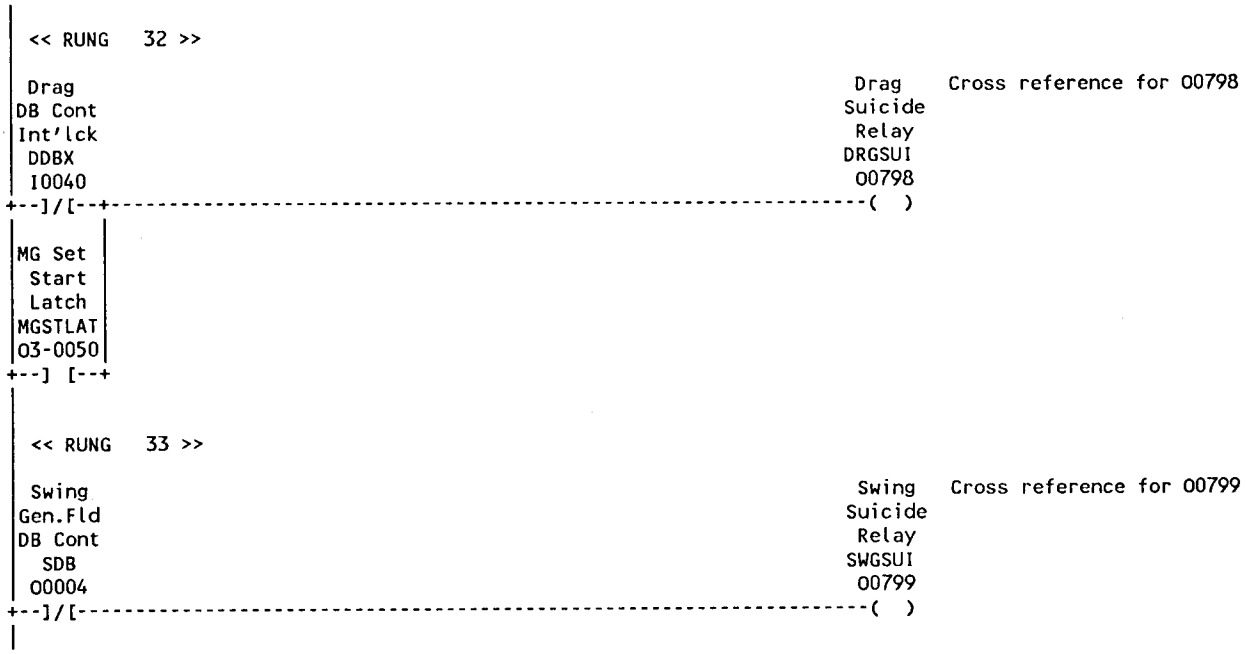
   F7 Displays Previous Page of the Event Code Table.

   F8 Displays Next Page of the Event Code Table.

   F9 Displays Event Code Table Help Screens.

   F10 Returns to Main Screen.

```
<< RUNG    0 >>



+[   Start of Program  ]-

<< RUNG    1 >>



+[SERIES SIX CONFIGURATION DATA]-

<< RUNG    2 >>



          Const   Const
+[ DO I/O START    END ]-[ SUSPEND I/O ]-                                ( )
          00737   00800

<< RUNG    3 >>

*******************************************************************************
*******************************************************************************
**                    PROGRAMMABLE CONTROL DOCUMENTATION                     **
**                                                                           **
**                                    FOR                                    **
**                                                                           **
**                    DRESSER/MARION TYPE 7820 DRAGLINE                      **
**                                                                           **
**                                                                           **
**                       Program File Name  D78213RB                         **
*******************************************************************************
*******************************************************************************



+[NO OP]-                                                                  ( )
```


<< RUNG 32 >>
Drag DB Cont Int'lck DDBX I0040
Drag Suicide Relay DRGSUI 00798
Cross reference for 00798
MG Set Start Latch MGSTLAT 03-0050
<< RUNG 33 >>
Swing Gen.Fld DB Cont SDB 00004
Swing Suicide Relay SWGSUI 00799
Cross reference for 00799

<< RUNG 58 >>

. .
. The next four rungs control the operator's Limit Bypass light and .
. Limit buzzer. .
. .

First Hoist Limit HL 1 O0-0747 --] [--

314 Lower Ref'nce Zeroed LLZREF O0-0745 --] [--

311 First Drag In Limit DL 1 O0-0754 --] [--

344 Pay Out Ref'nce Zeroed POZREF O0-0765 --] [--

341 Static Tight-lineTrp STLT O0-0759 --] [--

363

Limit Buzzer Moment. LIMBUZ1 O2-0901 --( )

Cross reference for O2- 0901

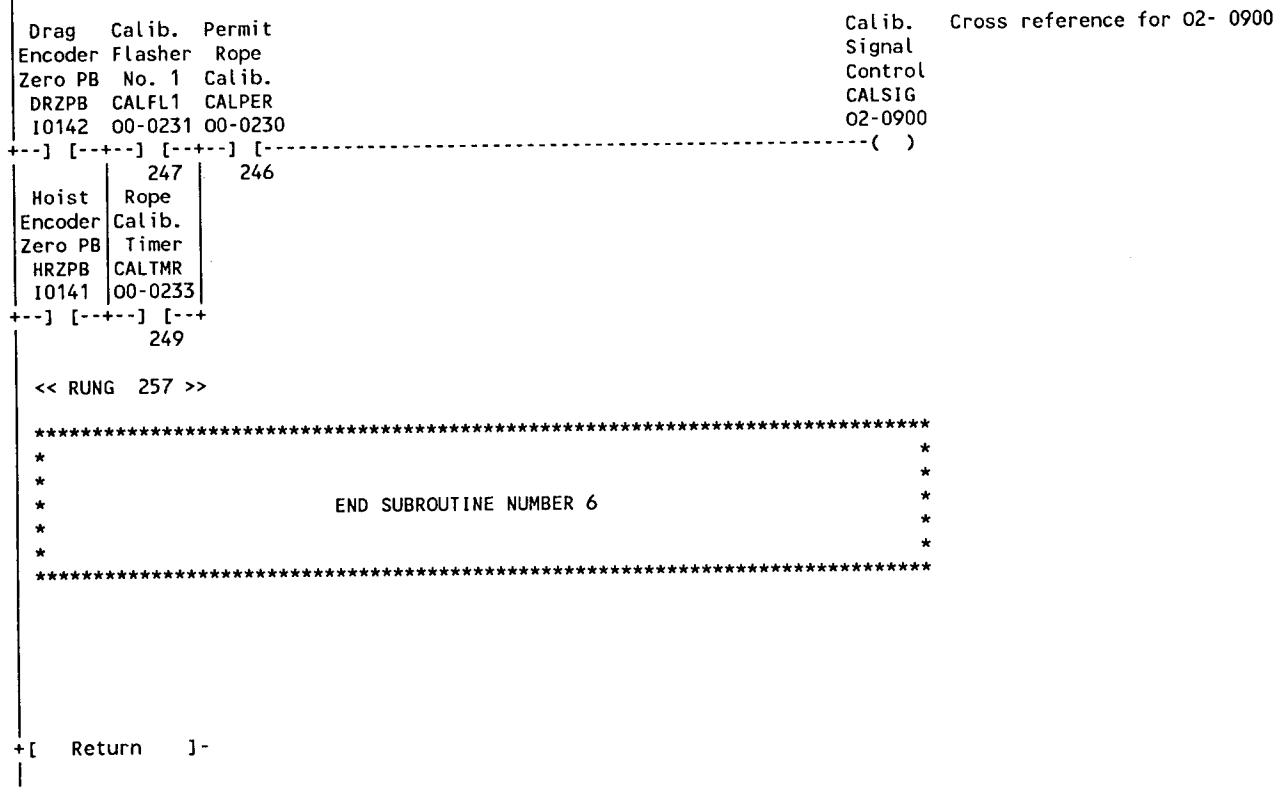
```
 << RUNG   94 >>

 ..........................................................................
 .                                                                        .
 .    The next 2 rungs are used to load the present state of the discrete .
 . I/O into Registers R2372 - R2374.                                      .
 .                                                                        .
 ..........................................................................

HstLoop          DISC'TE                 DISC'TE
 Inst.             I/O                     I/O
OvrCurr          737-752                 753-768
HLPIOC           DISC#1                  DISC#2
  I0737           R02372   I0753          R02373
+[   A     MOVE      B ]-[   A     MOVE      B ]-                    (  )

 << RUNG   95 >>

Disc'te          DISC'TE  Hoist          DISC'TE
  I/O              I/O   Mot.Fld          I/O
  785            785-800  Bit 1          49 - 64
DISCI/O          DISC#3  HMFBIT1         DISC#4
  00785           R02374   00049          R02375
+[   A     MOVE      B ]-[   A     MOVE      B ]-                    (  )
                          513

 << RUNG   96 >>

 Hoist            Hoist   Drag            Drag
Encoder          Encoder Encoder         Encoder
Reading          Reading Reading         Reading
 HENC            HENC X   DENC           DENC X
 R00951           R02362  R00952          R02363
+[   A     MOVE      B ]-[   A     MOVE      B ]-                    (  )

 << RUNG   97 >>

 ..........................................................................
 .                                                                        .
 .    The next rung performs the actual movement of data.                 .
 .                                                                        .
 ..........................................................................

GLOBAL
COMMAND
 BLOCK
GLBL1-2
 R0832
+[DPREQ]-                                                                (  )

 << RUNG   98 >>

 **************************************************************************
 *                                                                        *
 *                        END SUBROUTINE NUMBER 1                         *
 *                                                                        *
 **************************************************************************




+[   Return    ]-
```

```
 << RUNG  153 >>

 ********************************************************************************
 *                                                                              *
 *                        BEGIN SUBROUTINE NUMBER 3                             *
 *                                                                              *
 *                              Analog Input                                    *
 *                                                                              *
 *                                                                              *
 *    Each of the three Analog Input Modules provide 8 inputs. The inputs are  *
 * multiplexed and thus only one input from each Module would normally be      *
 * read in each scan. In order to obtain more frequent updates, this Sub-      *
 * routine is repeated 8 times in each scan.                                   *
 *    In the first of the following rungs, the Do I/O function is used to      *
 * read the inputs to Module No. 1 immediately. The first 8 bits of the        *
 * input, which contain the channel number, are separated from the second 8    *
 * bits, which contain the status code, and moved to R2876 to serve as the     *
 * pointer to the table of analog inputs, R2877-R2900.                         *
 *    If the status bits indicate that there are no faults the input value is  *
 * moved to the table.                                                         *
 *    The Analog Input Modules are analog to digital converters; the scaling   *
 * is from plus or minus 10 volts to plus or minus 2048 "counts". The next     *
 * Subroutine is used to convert from "counts" to engineering units.           *
 *                                                                              *
 ********************************************************************************




+[NO OP]-                                                                 (  )

 << RUNG  154 >>

                          An. In           Analog
                          Mod. 1            Input
                          Chan.No          Pointer
                          ANIN1CH          ANINPTR
         Const    Const    I0801            R02876
+[ DO I/O START   END ]-[  MOVE RIGHT 8 BITS  ]-                          (  )
         00801    00832

 << RUNG  155 >>

An.In 1 An.In 1 An. In  Analog
 Data    Board  Mod. 1   Input
 Valid    OK     Data   Pointer
ANIN1DV ANIN1BK ANIN1D  ANINPTR
 I0809   I0813   I0817  R02876   Const
+--] [-----] [---[ SRC-TO-TABLE    LEN]-                                  (  )
                                   024

 << RUNG  156 >>

                          An. In           Analog
                          Mod. 2            Input
                          Chan.No          Pointer
                          ANIN2CH          ANINPTR
         Const    Const    I0833            R02876
+[ DO I/O START   END ]-[  MOVE RIGHT 8 BITS  ]-                          (  )
         00833    00864
```

```
 << RUNG  207 >>

Analog          Analog
Output3         Output
Chnnl01         Mod. 3
ANO3CH1         ANOUT3
 R02839           00929
+[   A     MOVE      B ]-                                    (  )

 << RUNG  208 >>

 Never                                                      Analog   Cross reference for 00909
 Ener-                                                      Output1
 gized                                                       Bit 1   ] [  210, 212, 219, 221, 228, 23
EVEROFF                                                     ANO1B1   (  ) 217, 226, 235
00-0254                                                      00909
+--] [-------------------------------------------------------------(  )
    19

 << RUNG  209 >>

 Never                                                      Analog   Cross reference for 00910
 Ener-                                                      Output1
 gized                                                       Bit 2   ] [  211, 213, 220, 222, 229, 23
EVEROFF                                                     ANO1B2   (  ) 218, 227, 236
00-0254                                                      00910
+--] [-------------------------------------------------------------(  )
    19

 << RUNG  210 >>

Analog                                                      Analog   Cross reference for 00925
Output1                                                     Output2
 Bit 1                                                       Bit 1   (  ) 219, 228, 237
ANO1B1                                                      ANO2B1
 00909                                                       00925
+--] [-------------------------------------------------------------(  )
   208

 << RUNG  211 >>

Analog                                                      Analog   Cross reference for 00926
Output1                                                     Output2
 Bit 2                                                       Bit 2   (  ) 220, 229, 238
ANO1B2                                                      ANO2B2
 00910                                                       00926
+--] [-------------------------------------------------------------(  )
   209

 << RUNG  212 >>

Analog                                                      Analog   Cross reference for 00941
Output1                                                     Output3
 Bit 1                                                       Bit 1   (  ) 221, 230, 239
ANO1B1                                                      ANO3B1
 00909                                                       00941
+--] [-------------------------------------------------------------(  )
   208

 << RUNG  213 >>

Analog                                                      Analog   Cross reference for 00942
Output1                                                     Output3
 Bit 2                                                       Bit 2   (  ) 222, 231, 240
ANO1B2                                                      ANO3B2
 00910                                                       00942
+--] [-------------------------------------------------------------(  )
   209
```

Subroutine Number 6 - Calibration of Encoder Zero Positions

<< RUNG 256 >>



<< RUNG 257 >>

```
**********************************************************************************
*                                                                                *
*                                                                                *
*                          END SUBROUTINE NUMBER 6                               *
*                                                                                *
*                                                                                *
**********************************************************************************
```

+[Return]-

```
|
| << RUNG  293 >>
|
|                                                                            Fifty   Cross reference for 00- 0742
|                                                                            Scan
|                                                                            Timer
|                                                                            TIMER
|                                                                     Const  00-0742
+--------------------------------------------------------------------[PRESC]---(TH)
|                                                                       999    (  )
| Fifty                                                               50 Scan  (  )
| Scan                                                                 Timer   (  )
|Counter                                                               Accum   (  )
|SCNCNT                                                               TIME 50  (  )
| 01021                                                               R01092   (  )
+--] [---------------------------------------------------------------[ACCRG]---( R)
|   291
|
| << RUNG  294 >>
|
| Hoist          Hoist
|Length         Length
|M *100         Stk Ptr
|HLEN*C         HLENPTR
| R02376         R02751  Const
+[ SRC ADD-TO-TOP  LIST     LEN]-                                              (  )
|                           020
|
| << RUNG  295 >>
|
|                Hoist
|               Length
|               Stk Ptr
|               HLENPTR
|  Const         R02751
+[   A     MOVE      B ]-                                                      (  )
| +00019
|
| << RUNG  296 >>
|
| Hoist   Prev   SglPrec
|Length   Hoist  Working
|M *100  Length  Reg'ter
|HLEN*C   PHLEN  SPWR 1
| R02376  R02771  R01036
+[   A SUBX  B  =    C ]-                                                      (  )
|
|
| << RUNG  297 >>
|
|SglPrec Average SglPrec
|Working  Hoist  Working
|Reg'ter Change  Reg'ter
|SPWR 1  AVHSTCH SPWR 1
| R01036  R01107  R01036
+[   A ADDX  B  =    C ]-                                                      (  )
|
|
| << RUNG  298 >>
|
|SglPrec         DblPrec         DblPrec               Average SglPrec
|Working         Working         Working                Hoist  Working
|Reg'ter         Reg'ter         Reg'ter               Change  Reg'ter
|SPWR 1          DPWR 1L         DPWR 1L               AVHSTCH SPWR 3
| R01036   Const  R01038          R01038         Const  R01107  R01075
+[   A MPY   B  =    C          ]-[   A     DVD      B     QUO     REM ]-  (  )
|        +00001                                +00002
```

```
*
* << RUNG  344 >>
*
* ..........................................................................
* .                                                                        .
* .    This rung checks if the drag-in zero reference point has been reached.  .
* .                                                                        .
* ..........................................................................
*
* Drag    First  SglPrec General         Limited RopeLim  Limit          First   Cross reference for 00- 0754
*Length  DragLim Working Purpose         Drag    Bypass   Overrde        Drag In
*M *100  Set Pt. Reg'ter Reg'ter         Ref'nce PB Lat   Relay          Limit   ] [  58, 587
*DLEN*C  SP 802  SPWR 2  CONST=0         LIMDREF RLBPLAT LIMO'RD        DL 1
* R02378  R03662  R01037  R00900          R00865 00-0735 00-0733        00-0754
+[   A SUBX  B  =    C ]-[   A     MOVE      B ]---]/[-----]/[------------(  )
*                                                54       7
*
* << RUNG  345 >>
*
* ..........................................................................
* .                                                                        .
* .    This section checks if the drag-in trip limit has been exceeded for     .
* . more than 0.05 seconds and shuts down the drive accordingly.              .
* .                                                                        .
* ..........................................................................
*
* Drag    Final  SglPrec                                                  DrgTrip  Cross reference for 00- 0755
*Length  DragLim Working                                                  Limit
*M *100  Set Pt. Reg'ter                                                  Aux'ary  ] [  346
*DLEN*C  SP 803  SPWR 2                                                   DLX 2    ]/[  346
* R02378  R03663  R01037                                                  00-0755
+[   A SUBX  B  =    C ]-----------------------------------------------------(  )
*
*
* << RUNG  346 >>
*
*DrgTrip                                                                   Final    Cross reference for 00- 0756
* Limit                                                                    Drag
*Aux'ary                                                                   Limit    ] [  54, 59, 61, 348
* DLX 2                                                                    DL 2     ]/[  50
*00-0755                                                          Const   00-0756
+--] [-------------------------------------------------------------[PRESC]---(TH)
*   345                                                             005      (  )
*DrgTrip                                                          Drag      (  )
* Limit                                                           Limit 2   (  )
*Aux'ary                                                          AccTime   (  )
* DLX 2                                                           DL2TIME   (  )
*00-0755                                                          R01096    (  )
+--]/[-------------------------------------------------------------[ACCRG]---( R)
*   345
|
|  << RUNG  347 >>
|
|
|
|
|
+[NO OP]-                                                                   (  )
|
```

```
<< RUNG  391 >>

*****************************************************************************
*                                                                           *
*                          SUBROUTINE NUMBER 9                              *
*                                                                           *
*                            DRIVE CONTROL                                  *
*                                                                           *
*                                                                           *
*****************************************************************************




+[NO OP]-                                                          (  )

<< RUNG  392 >>

.............................................................................
.                                                                           .
.    The next 19 rungs are used to sense the quadrant in which each of the  .
. drives (hoist, drag, swing and flywheel) is operating. Voltage and current .
. polarities are detected. Both are positive for quadrant 1 and both are    .
. negative for quadrant 3. Voltage is positive and current is negative in   .
. quadrant 2 while the opposites exist in quadrant 4.                       .
.                                                                           .
.............................................................................




+[NO OP]-                                                          (  )

<< RUNG  393 >>

        Hoist   Value                                               Hoist   Cross reference for 00- 0115
        Arm.     Not                                               Gen.Vlt
       V. x 10  Req'd                                             Positiv  ] [  395, 396
       HVFBVLT NOTREQD                                            HVFBPOS  ]/[  397, 398
  Const R02341  R00769                                            00-0115
+[   A SUBX  B  =    C ]-------------------------------------------(  )
 +00000

<< RUNG  394 >>

        Hoist   Value                                               Hoist   Cross reference for 00- 0116
        Arm.     Not                                               Arm.Cur
        Amps.   Req'd                                              Positiv  ] [  395, 398
       HCFBAMP NOTREQD                                            HCFBPOS  ]/[  396, 397
  Const R02344  R00769                                            00-0116
+[   A SUBX  B  =    C ]-------------------------------------------(  )
 +00000

<< RUNG  395 >>

 Hoist   Hoist                                                      Hoist   Cross reference for 00- 0111
Gen.Vlt Arm.Cur                                                     Quad-
Positiv Positiv                                                     rant I   ] [  499, 510
HVFBPOS HCFBPOS                                                     H QUAD1
00-0115 00-0116                                                     00-0111
+--] [-----] [--------------------------------------------------------(  )
   393     394
```

```
*
* << RUNG  441 >>
*
* ..........................................................................
* .                                                                        .
* .    The next 4 rungs limit the reference to the values preset through the   .
* . OIT.                                                                   .
* .                                                                        .
* ..........................................................................
*
* Hoist          SglPrec
* Max.           Working
*Ref'nce         Reg'ter
*HMXREF           SPWR
* R03532           R00799
+[   A     MOVE      B ]-                                              (  )
*
*
* << RUNG  442 >>
*
* Hoist  SglPrec DblPrec         DblPrec                 Hoist   Value
*Mast.Sw Working Working         Working                 Mast.Sw   Not
*Shaped  Reg'ter Reg'ter         Reg'ter                 Shaped   Req'd
*HMSSHPD  SPWR    DPWR1           DPWR1                  HMSSHPD NOTREQD
* R00802  R00799  R00800          R00800          Const  R00802  R00769
+[   A MPY   B  =    C         ]-[   A    DVD        B     QUO     REM ]-  (  )
*                                                 +00800
*
* << RUNG  443 >>
*
*SglPrec  Hoist   Value  SglPrec          Hoist                          Skip    Cross reference for 00- 0751
*Working Mast.Sw   Not   Working         Mast.Sw                         Delim-
*Reg'ter Shaped   Req'd  Reg'ter         Shaped                           iter   (  ) 83, 322, 352, 379, 447, 474
* SPWR    HMSSHPD NOTREQD  SPWR          HMSSHPD                         ENDSKIP      555, 582, 586, 591, 608, 71
* R00799  R00802  R00769  R00799          R00802                         00-0751
+[   A SUBX  B  =    C ]-[   A     MOVE      B ]-------------------------(  )
*
*
* << RUNG  444 >>
*
*Multi-
*Purpose
* Relay
* MPR1
*00-0100  Const
+--]/[---[SKIP ]-                                                        (  )
*   439     001
*
* << RUNG  445 >>
*
* Lower          SglPrec
* Max.           Working
*Ref'nce         Reg'ter
*LMXREF           SPWR
* R03533           R00799
+[   A     MOVE      B ]-                                              (  )
*
*
* << RUNG  446 >>
*
* Hoist  SglPrec DblPrec         DblPrec                 Hoist   Value
*Mast.Sw Working Working         Working                 Mast.Sw   Not
*Shaped  Reg'ter Reg'ter         Reg'ter                 Shaped   Req'd
*HMSSHPD  SPWR    DPWR1           DPWR1                  HMSSHPD NOTREQD
* R00802  R00799  R00800          R00800          Const  R00802  R00769
+[   A MPY   B  =    C         ]-[   A    DVD        B     QUO     REM ]-  (  )
*                                                 -00800
```

```
 << RUNG  482 >>

 ..........................................................................
 .                                                                        .
 .    This rung establishes the reference decrease ramp for normal hoist  .
 . conditions while the following rung applies when selecting the spreader .
 . bar tension mode.                                                      .
 .                                                                        .
 ..........................................................................

Not In   Hoist  Ref'nce  Hoist   Hoist   Hoist
 Hoist  Ref'nce Counter Old/New Ref'nce Old/New
Tension Decreas 1/Scan  Ref'nce  Adder  Ref'nce
NOTTENS HREFDEC RC1/SC  HO/NREF HREFADD HO/NREF
O3-0061 O0-0151  O1005   R00805  R00806  R00805
+--] [-----] [-----] [---[   A ADDX  B  =    C ]-                    ( )
          476     413

 << RUNG  483 >>

Not In   Hoist  Ref'nce  Hoist   Hoist   Hoist
 Hoist  Ref'nce Counter Old/New Ref'nce Old/New
Tension Decreas 1/2Scan Ref'nce  Adder  Ref'nce
NOTTENS HREFDEC RC1/2SC HO/NREF HREFADD HO/NREF
O3-0061 O0-0151  O1006   R00805  R00806  R00805
+--]/[-----] [-----] [---[   A ADDX  B  =    C ]-                    ( )
          476     414
*
* << RUNG  484 >>
*
* Hoist           Value
*Old/New           Not
*Ref'nce          Req'd
*HO/NREF         NOTREQD
* R00805   Const  R00769  Const
+[   A SUBX  B  =    C ]-[SKIP ]-                                     ( )
*         +00000            001
*
* << RUNG  485 >>
*
*Sft'wre
*LineExc
*Aux'ary
*  LEX
*O3-0049  Const
+--]/[---[SKIP ]-                                                     ( )
*           001
*
* << RUNG  486 >>
*
* Hoist          DblPrec         DblPrec                SglPrec  Value
* Arm.           Working         Working                Working   Not
*V. x 10         Reg'ter         Reg'ter                Reg'ter  Req'd
*HVFBVLT          DPWR1           DPWR1                  SPWR   NOTREQD
* R02341   Const  R00800          R00800          Const  R00799  R00769
+[   A MPY   B  =    C         ]-[   A    DVD        B     QUO     REM ]-  ( )
*         +00800                                   +06000
*
* << RUNG  487 >>
*
*SglPrec         SglPrec
*Working         Working
*Reg'ter         Reg'ter
* SPWR             SPWR
* R00799   Const  R00799
+[   A ADDX  B  =    C ]-                                             ( )
*         +00100
```

```
 << RUNG  519 >>

 ..............................................................................
 .                                                                            .
 .    The following rung calculates the multiplier which will be used to      .
 . alter the swing master switch signal, depending upon the quadrant and      .
 . armature voltage.                                                          .
 .                                                                            .
 ..............................................................................

SglPrec  Swing   Swing          Swing                  Swing   Value
Working Voltage Current        Current                SubTemp   Not
Reg'ter Mult'er Sub'end        Sub'end                Reg'ter  Req'd
 SPWR   SVLTMUL SCURSUB        SCURSUB                SSUBREG NOTREQD
 R00799  R00943  R02907         R02907          Const  R02929  R00769
+[   A MPY    B  =    C        ]-[   A    DVD        B     QUO     REM ]-  (  )
                                                 +01000

 << RUNG  520 >>

 ******************************************************************************
 *                                                                            *
 *                          SWING MASTER SWITCH SHAPING                       *
 *                                                                            *
 *    The following 9 rungs create a low gain region around the master switch *
 * neutral postion. As for the hoist master switch, the signal is reduced to  *
 * one-fourth for the first one-fourth of handle travel. Refer to the hoist   *
 * explanation for more details.)                                             *
 *                                                                            *
 ******************************************************************************

 Swing          DblPrec         DblPrec                  Swing   Value
Mast.Sw         Working         Working                  Mast.Sw   Not
V. x100         Reg'ter         Reg'ter                  Shaped   Req'd
SMSVIN           DPWR1           DPWR1                   SMSSHPD NOTREQD
 R02340   Const  R00800          R00800          Const  R00807  R00769
+[   A MPY    B  =    C        ]-[   A    DVD        B     QUO     REM ]-  (  )
         +00001                                  +00004

 << RUNG  521 >>

        Swing  SglPrec                                                  Multi-   Cross reference for 00- 0100
       Mast.Sw Working                                                  Purpose
       V. x100 Reg'ter                                                   Relay   ] [  119, 383, 384, 385, 387, 38
       SMSVIN   SPWR                                                     MPR1          433, 435, 436, 437, 440, 49
  Const  R02340  R00799                                                 00-0100       524, 526, 527, 528, 532, 53
+[   A SUBX  B  =    C ]-----------------------------------------------(  )           575, 576, 577, 579, 622, 62
 +00200                                                                            ]/[  444, 497, 583, 623, 627
                                                                                   (  ) 118, 382, 386, 430, 434, 43
                                                                                        570, 574, 578, 620, 624, 69

 << RUNG  522 >>

Multi-  SglPrec         DblPrec
Purpose Working         Working
 Relay  Reg'ter         Reg'ter
 MPR1    SPWR           DPWR1
00-0100  R00799   Const  R00800
+--] [---[   A MPY   B  =    C        ]-                                  (  )
   521           +00005

 << RUNG  523 >>

Multi-  DblPrec                 SglPrec  Value
Purpose Working                 Working   Not
 Relay  Reg'ter                 Reg'ter  Req'd
 MPR1    DPWR1                   SPWR   NOTREQD
00-0100  R00800           Const  R00799  R00769
+--] [---[   A    DVD        B     QUO     REM ]-                          (  )
   521                    -00004
```

```
<< RUNG  561 >>

. . . . . .
.                                                                      .
.    This rung provides for obtaining a low value of motor field current .
. when the master switch is in neutral and the armature voltage is low for .
. the prescribed period of time.                                       .
.                                                                      .
. . . . . .

 Swing   Swing          Value          Swing   Value                    Swing   Cross reference for 00- 0128
Mast.Sw  Arm.           Not            Arm.    Not                     MS Neut
Neutral V. x 10         Req'd          V. x 10 Req'd                    Timer   ] [  564
SNEUTRL SVFBVLT        NOTREQD         SVFBVLT NOTREQD                 SNEUTMR
02-0889  R02343  Const  R00769  Const  R02343  R00769          Const  00-0128
+--] [---[  A SUBX  B  =    C ]-[  A SUBX  B  =    C ]---------[PRESC]---(TT)
   425          +00500          -00500                          020     (  )
 Swing                                                        Swing     (  )
Mast.Sw                                                      Neutral     (  )
Neutral                                                       Time       (  )
SNEUTRL                                                      SNEUTRG     (  )
02-0889                                                      R02248      (  )
+--]/[-------------------------------------------------------[ACCRG]---( R)
   425

 << RUNG  562 >>

. . . . . .
.                                                                      .
.    The following rungs provide control of the swing motor field exciter .
. similar to that described previously for the hoist motion.           .
.                                                                      .
. . . . . .

                                                                Swing   Cross reference for 00- 0267
                                                               Mot.Fld
                                                               Strong   ] [  565, 566
                                                                SMFST
                                                               00-0267
+[NO OP]-------------------------------------------------------------(  )
```

<< RUNG 598 >>

This voltage relay is used to change the referance ramp to prevent excessive current excursions when plugging from high speed payout.

Drag Arm. V. x 10 DVFBVLT R02342 Const

Value Not Req'd NOTREQD R00769

A SUBX B = C] -05500

Payout Voltage Relay PAYVLTG 00-0168

Cross reference for 00- 0168

] [599, 601
]/[599, 601

<< RUNG 599 >>

This rung selects the reference ramp to be used for increasing the reference according to the quadrant and voltage level.

Dig Mode Status	Drag Ref'nce Increas	Drag Quad- rant II	Drg Q12 Ref'nce Voltage Relay	Counter 1/Scan	Drag Old/New ref'nce	Drag Ref'nce Adder	Drag Old/New ref'nce
DIGMODE 03-0059	DREFINC 00-0165	D QUAD2 00-0132	DRGVLTG 00-0167	RC1/SC 01005	DO/NREF R00971	DREFADD R00926	DO/NREF R00971

A SUBX B = C]- ( )

592 | 408 | 595 | 413

Drg Q12 Ref'nce Voltage Relay	Counter 1/2Scan
DRGVLTG 00-0167	RC1/2SC 01006

595 | 414

Drag Quad- rant IV	Payout Voltage Relay	Ref'nce Counter 1/Scan
D QUAD4 00-0134	PAYVLTG 00-0168	RC1/SC 01005

410 | 598 | 413

Payout Voltage Relay	Ref'nce Counter 1/2Scan
PAYVLTG 00-0168	RC1/2SC 01006

598 | 414

Drag Quad- rant II	Drag Quad- rant IV	Ref'nce Counter 1/Scan
D QUAD2 00-0132	D QUAD4 00-0134	RC1/SC 01005

408 410 413

<< RUNG 636 >>

Drag Mot.Fld Strong DMFST 00-0264 — Drag Mot.Fld Weak DMFWK 00-0266 — Dig Mode Status DIGMODE 03-0059 —]/[— Drag Mot.Fld Bit 1 DMFBIT1 00051 — ( )

Cross reference for 00051

632 Drag Mot.Fld Medium DMFMED 00-0265 —]/[

635 — [

633 Propel Mot.Fld Bit 1 PMFBIT1 00057 — Propel Mode Status PRPMODE 03-0060 — [— [

643

<< RUNG 637 >>

Drag Mot.Fld Strong DMFST 00-0264 — Drag Mot.Fld Medium DMFMED 00-0265 — Drag Mot.Fld Weak DMFWK 00-0266 — Dig Mode Status DIGMODE 03-0059 —]/[—]/[— [— Drag Mot.Fld Bit 2 DMFBIT2 00052 — ( )

Cross reference for 00052

632 —]/[

633 Propel Mot.Fld Bit 2 PMFBIT2 00058 — Propel Mode Status PRPMODE 03-0060 — [— [

635 — [

644

<< RUNG 638 >>

****

* PROPEL MOTOR FIELD CONTROL *

****

Propel Mast.Sw Neutral LPNEUT 02-0892 — Propel Mode Status PRPMODE 03-0060 —] [— Propel Off Auxil. PROFF 00-0273 — ( )

Cross reference for 00- 0273

] [639

]/[639

426 Hoist DB Cont Int'lck HDBX I0039 — Drag DB Cont Int'lck DDBX I0040 —]/[—]/[

Propel Brake PressSw PBRKPS I0194 —]/[

```
 << RUNG  674 >>

 ********************************************************************************
 *                                                                              *
 *                           SUBROUTINE NUMBER 11                               *
 *                                                                              *
 *                            SOFT START CONTROL                                *
 *                                                                              *
 *    The drag generator is used as a motor when Soft Starting the Motor-       *
 * Generator Set. Its shunt field current is supplied by its normal exciter     *
 * and its armature current is supplied by the Power Conversion Module (PCM).   *
 * Synchronous motor field current is supplied by the swing generator field     *
 * exciter while synchronizing and by the PCM in normal operation.              *
 *    The same Subroutine is used for the three Regulators used during Soft     *
 * Starting. The next 4 rungs provide the constants required by these Reg-      *
 * ulators. The first block is for the drag generator field current regula-     *
 * tor, the second is for the PCM speed regulator and the third is for the      *
 * synchronous motor voltage regulator. The constants provided are, in order,   *
 * input resistance, feedback resistance, lead circuit resistance, lag cir-     *
 * cuit resistance, lead circuit capacitor function, lag circuit capacitor      *
 * function, and maximum value for the output. The capacitor function is        *
 * equal to the scan time divided by the capacitance.                           *
 *                                                                              *
 ********************************************************************************

+[NO OP]-                                                              (  )

 << RUNG  675 >>

MG Set                                                          SftStrt  Cross reference for O1020
 Start                                                           Start
 Latch                                                          1-Shot   ] [  676, 677, 679, 680, 681
MGSTLAT                                                          SSOS    ]/[  678
O3-0050                                                          O1020
+--] [-------------------------------------------------------------------(OS)

 << RUNG  676 >>

SftStrt
 Start
1-Shot
 SSOS    RES1D
 O1020   R01502
+--] [---[                        BLOCK MOVE                          ]-  (  )
   675          +30000  +30000  +20000  +00000  +00168  +00000  +00800

 << RUNG  677 >>

SftStrt
 Start
1-Shot
 SSOS    RES1S
 O1020   R01522
+--] [---[                        BLOCK MOVE                          ]-  (  )
   675          +01000  +01000  +10000  +00000  +00000  +00000  +01000
```

```
 << RUNG  729 >>

 Sync.                                                                  Synchro  Cross reference for 00794
 Card                                                                   Permiss
  ON                                                                     -ive
SYNCHON                                                                 SASCON
A00300                                                                   00794
+--]/[-------------------------------------------------------------------(  )
   728

 << RUNG  730 >>

 .....................................................................
 .                                                                   .
 .    When the frequency (speed) and phase relationship are correct, the
 . synchronizing card provides the Synchronize signal, which is used by CPU
 . No. 2 to energise the closing coil for the vacuum circuit breaker. When
 . the VCB closes, CPU No. 2 provides the VCB Closed signal.        .
 .    After the VCB closes, the calculated average swing reference is used to .
 . hold the synchronous motor excitation at the level used in matching the
 . motor voltage to the machine voltage.                            .
 .                                                                   .
 .....................................................................

SftStrt SftStrt Average         SftStrt
  VCB     SYMF   Voltage         Voltage
Closed  To PCM  Ref'nce         Reg.Ref
VCBCLSD SYMFPCM AVVREF          SSVREF
03-0053 03-0054  R01300          R01558
+--] [-----]/[---[   A     MOVE      B ]-                              (  )

 << RUNG  731 >>

SftStrt SftStrt General         SftStrt
  VCB     SYMF   Purpose         Speed
Closed  To PCM  Reg'ter         Reg.Ref
VCBCLSD SYMFPCM CONST=0         SSSPREF
03-0053 03-0054  R00900          R01538
+--] [-----]/[---[   A     MOVE      B ]-                              (  )

 << RUNG  732 >>

SftStrt SftStrt         SftStrt SftStrt
  VCB     SYMF          Voltage Voltage
Closed  To PCM          Reg.Ref Reg.Ref
VCBCLSD SYMFPCM         SSVREF  SSVREF
03-0053 03-0054   Const  R01558  R01558
+--] [-----] [---[   A ADDX  B  =    C ]-                             (  )
               +00001

 << RUNG  733 >>

SftStrt SftStrt Average         SftStrt
  VCB     SYMF   Voltage         Working
Closed  To PCM  Ref'nce         Reg. 1
VCBCLSD SYMFPCM AVVREF           SSWR1
03-0053 03-0054  R01300   Const  R01197
+--] [-----] [---[   A MPY   B  =    C        ]-                      (  )
                      +00001
```

***** UNREFERENCED RUNG EXPLANATION LIST *****

NO UNREFERENCED RUNG NUMBERS FOUND

***** A U X I N P U T S T A T U S T A B L E *****

AUX INPUT	NAME/ NICKNAME	CROSS REFERENCE

( ) = implicit references
MNE = mnemonic references

***** I N T E R N A L O U T P U T S T A T U S T A B L E *****

C H A N N E L N U M B E R 0-

INT OUTPUT	NAME/ NICKNAME	CROSS REFERENCE
0231	Calib. Flasher No. 1 CALFL1 :	] [248, 256 (TT) 247
0232	Calib. Flasher No. 2 CALFL2 :	] [247, 248 (TT) 248
0233	Rope Calib. Timer CALTMR :	] [49, 50, 250, 252, 253, 255, 256, 262, 268 (TT) 249
0238	Hoist Enc BCD Fault HBCDFLT :	] [261 ( ) 260
0239	Drag Enc BCD Fault DBCDFLT :	] [267 ( ) 259
0240	Hoist Encoder Check 1 HENCOK1 :	] [266 ( ) 264
0241	Hoist Encoder Check 2 HENCOK2 :	] [266 ( ) 265
0242	Hoist Encoder Check 3 HENCOK3 :	] [273, 277, 278]/[39, 273, 283 ( ) 266
0243	Drag Encoder Check 1 DENCOK1 :	] [272 ( ) 270
0244	Drag Encoder Check 2 DENCOK2 :	] [272 ( ) 271
0245	Drag Encoder Check 3 DENCOK3 :	] [274, 279, 280]/[39, 274, 283 ( ) 272
0246	H. Enc. Check Timer HENCTD :	] [275, 277]/[273, 281 (TH) 273
0247	D. Enc. Check Timer DENCTD :	] [276, 279]/[274, 282 (TH) 274

***** I N T E R N A L O U T P U T S T A T U S T A B L E *****

C H A N N E L N U M B E R 2-

INT OUTPUT	NAME/ NICKNAME	CROSS REFERENCE
0894	Reg'tor : Proving Relay RPRX	( ) 9
0895	Hoist : Shut-down HSCR	( ) 49
0896	Drag : Shut-down DSCR	( ) 50
0897	Hoist : Encoder Enabled HENCOK	]/[43 ( ) 281
0898	Drag : Encoder Enabled DENCOK	]/[43 ( ) 282
0899	Tight- : line Limit TLLIM	( ) 371
0900	Calib. : Signal Control CALSIG	( ) 256
0901	Limit : Buzzer Moment. LIMBUZ1	( ) 58
0902	Limit : Buzzer On LIMBUZ2	( ) 59
0903	GenVltg : Proving Relay VPRAUX	] [9 ( ) 13
0904	Sft'wre : Proving Relay SPRAUX	] [9 ( ) 17
0905	Limit : Light Flash LIMIL1	( ) 60

***** R E G I S T E R S T A T U S T A B L E *****

REGISTER/ VALUE	NAME/ NICKNAME	CROSS REFERENCE
R00949 [00582]	Swing Quad.4 Max Ref SMXREF4 :	147, 149, 537, 540, 540
R00950 [64737]	Swing Quad.3 Max Ref SMXREF3 :	148, 537, 539, 539
R00951 [06401]	Hoist Encoder Reading HENC :	96, 250, 252, 260, 262, 263, 264, 265, 277
R00952 [03708]	Drag Encoder Reading DENC :	96, 253, 255, 259, 268, 269, 270, 271, 279
R00955 [00000]	Drag Q1 Current Sub'end D1CUSUB :	614, 614
R00957 [00270]	Drag Voltage Mult'er DVLMUL :	611, 613, 614
R00961 [00000]	Drag Mast.Sw Shaped DMSSHPD :	569, 573, 577, 578, 581, 581, 582, 582, 585, 585, 586, 586, 587, 589, 590, 590, 591, 591, 5
R00971 [00000]	Drag Old/New ref'nce DO/NREF :	592, 593, 599, 599, 600, 600, 601, 601, 602, 602, 603, 604, 608, 608, 609
R00983 [64724]	Propel Current Sub'end PCURSUB :	621, 621, 625, 625
R00985 [00130]	Propel Ampere Sub'end PAMPSUB :	621, 622, 625, 626
R01009 [06597]	Sync. Voltage Ref'nce SYNVREF :	709, 712, 712, 713, 713, 714
R01010 [00000]	M/G Set Spd Ref In RPM MGSPDRF :	691, 693, 694, 694, 696, 696, 700, 700, 701, 701, 702

***** R E G I S T E R S T A T U S T A B L E *****

REGISTER/ VALUE	NAME/ NICKNAME		CROSS REFERENCE
R02342 [65526]	Drag Arm. V. x 10 DVFBVLT	:	12, 12, 169, 405, 595, 595, 597, 597, 598, 606, 610, 612, 620, 624, 629, 629, 630, 630
R02343 [65471]	Swing Arm. V. x 10 SVFBVLT	:	11, 11, 170, 399, 516, 517, 558, 558, 559, 559, 561, 561
R02344 [00015]	Hoist Arm. Amps. HCFBAMP	:	171, 394, 449, 511
R02345 [00074]	Drag Lp1Arm. Amps. DCFBAMP	:	172, 406, 634
R02346 [65486]	Drag Lp2Arm. Amps. D2CFBA	:	173
R02347 [00001]	Swing Armatur Amps SCFBAMP	:	174, 546, 547, 551
R02348 [63578]	Hst.Mtr Fld.Amp x 100 HMFAMP	:	175, 449
R02349 [65521]	Drg.Gen Fld.Amp X 100 DGFAMP	:	176, 687, 687, 689, 703
R02351 [00012]	Machine AC Current IMACH	:	177
R02352 [00064]	AC Gen. Kilo- watts ACKW	:	178
R02353 [65527]	AC Gen. Kilo- vars ACKVAR	:	179
R02354 [00905]	Air Press. PSI X10 AIRPSI	:	182

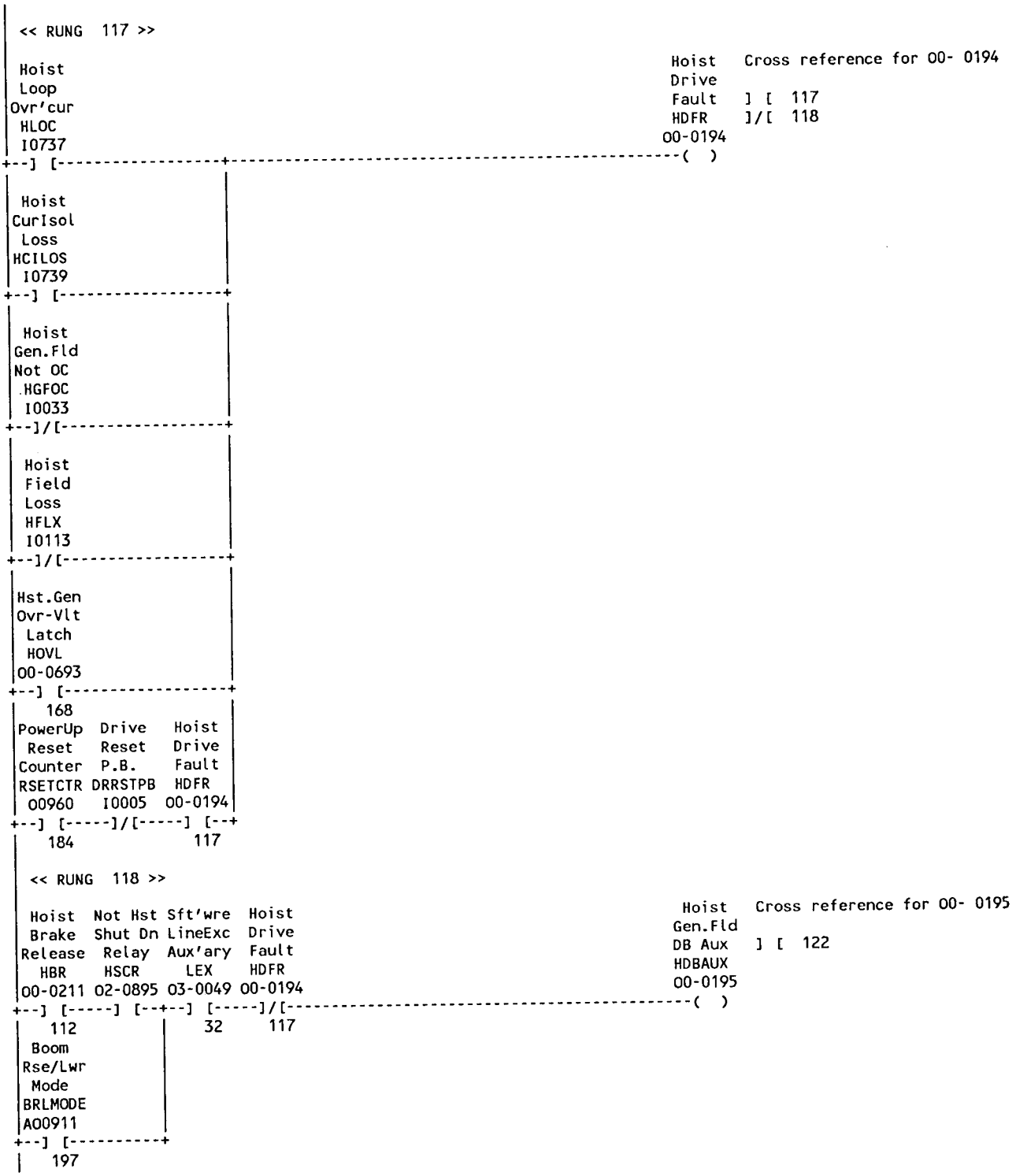
***** R E G I S T E R S T A T U S T A B L E *****

REGISTER/ VALUE	NAME/ NICKNAME	CROSS REFERENCE
R03532 [00800]	Hoist Max. Ref'nce HMXREF	: 121, 322, 323, 372, 378, 382, 441, 645
R03533 [64736]	Lower Max. Ref'nce LMXREF	: 313, 384, 445, 645
R03534 [05500]	HstRlay Pickup Q1& Q2 HVRELAY	: 150, 505
R03535 [00100]	Tension Current Level H SBTRI	: 124, 499, 502
R03551 [02088]	Drag Q1 PeakPwr Amperes D1PKAMP	: 129
R03552 [63448]	Drag Q3 PeakPwr Amperes D3PKAMP	: 133
R03553 [03600]	Drag Stall Current D STALL	: 129, 133, 137, 615
R03554 [00800]	Drag Forward Max.Ref DFMXREF	: 130, 352, 353, 386, 580, 646
R03555 [64736]	Drag Reverse Max.Ref DRMXREF	: 134, 343, 388, 584, 586, 586, 646
R03556 [05700]	DrgRlay Pickup Q1 & Q2 DVRPKUP	: 151, 595, 596
R03576 [02088]	Propel PeakPwr Amperes P PKAMP	: 138, 142
R03577 [03960]	Propel Forward Stall A PFSTALL	: 138, 622, 623

```
 << RUNG    4 >>

 ***************************************************************************
 *                                                                         *
 *                      BEGIN GENERAL DRIVE MANAGEMENT                     *
 *                                                                         *
 ***************************************************************************




+[NO OP]-                                                                 (  )

 << RUNG    5 >>
                                                                   Propel   Cross reference for 03- 0069
 Never                                                             LimitSw
 Ener-                                                              Mode    ] [  96, 97
 gized                                                             PRPLSMD  ]/[  96, 97
EVEROFF                                                            03-0069
00-0254
+--] [------------------------------------------------------------(  )
   178

 << RUNG    6 >>

 ...........................................................................
 .                                                                         .
 .   Next few rungs check for Critical Blocks at power-up to determine if  .
 . they are "alive". This is done by putting an incorrect value on a block .
 . point, if it doesn't change then the block is "dead". The blocks are    .
 . grouped and determined if they will effect the LE Chain or M/G Set logic.  .
 .                                                                         .
 ...........................................................................

CntlBus                     Hoist
Cntrllr                     Joystck
OK Timr                     Input
CBOKOS                      HMSIN
A00703    Const             R07026
+--] [---[   A      MOVE       B ]-                                       (  )
    18    +10000

 << RUNG    7 >>

SensBus                     Propel                   MG Set1
Cntrllr                      Right                   Bearing
OK Timr                      Outer                   #1 Temp
SBOKTMR                     PROUTER                  MGBR1OT
A00704    Const              R07001    Const          R07008
+--] [---[   A      MOVE       B ]-[    A     MOVE       B ]-             (  )
    23    +10000                       +10000

 << RUNG    8 >>

SensBus                     MG Set1                  Propel
Cntrllr                     Bearing                   Left
OK Timr                     #8 Temp                   Outer
SBOKTMR                     MGBR8OT                  PLOUTER
A00704    Const              R07014    Const          R07020
+--] [---[   A      MOVE       B ]-[    A     MOVE       B ]-             (  )
    23    +10000                       +10000
```

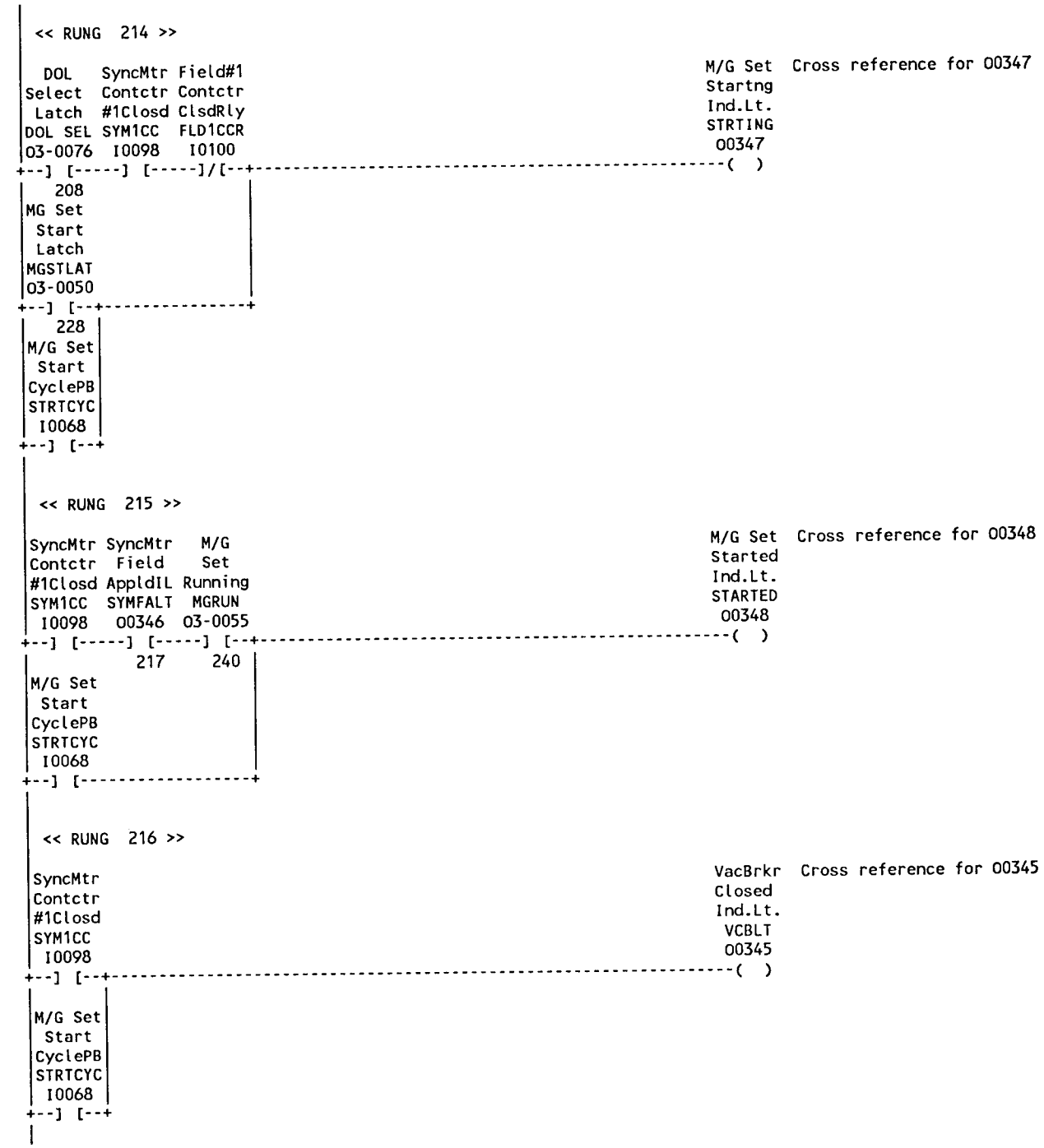
```
 |
 | << RUNG    42 >>
 |
 | Power                   General
 |  Up                     Purpose
 | Scan                    Reg'ter
 |PUPSCAN                  CONST=4
 | 00950    Const           R00904
+--]/[---[   A      MOVE       B ]-                                  (  )
 |   282   +00004
 |
 | << RUNG    43 >>
 |
 | .............................................................................
 | .                                                                           .
 | .    Blowers, Oil Pumps, Filter Fans, Bleed Duct Fans, and Anti-Condensation .
 | . Heaters Control.                                                          .
 | .                                                                           .
 | .............................................................................
 |
 |
 |
 |
 |
+[NO OP]-                                                            (  )
 |
 |
 | << RUNG    44 >>
 |
 |DC Motr DC Motr                                                 DC Motr  Cross reference for 00361
 |Blowers Blowers                                                 Blower
 |StartPB Stop PB                                                 Starter
 |STRTBLW STOPBLW                                                 BLWSTTR
 | I0069   I0070                                                   00361
+--] [--+--] [----------------------------------------------------------(  )
 |       |
 |Blowers|
 |Running|
 | Relay |
 |BLOWERS|
 | I0168 |
+--] [--+
 |
 |
 | << RUNG    45 >>
 |
 |Blowers                                                         Blowers  Cross reference for 00340
 |Running                                                         Running
 | Relay                                                          Ind.Lt.
 |BLOWERS                                                         BLWRSIL
 | I0168                                                           00340
+--] [--+---------------------------------------------------------------(  )
 |       |
 |M/G Set|
 | Start |
 |CyclePB|
 |STRTCYC|
 | I0068 |
+--] [--+
 |
```

```
|
|  << RUNG   81 >>
|
|         Drag   SglPrec                    Drag
|        Ref'nce Working                   Ref'nce
|        I.Buff1 Reg'ter                   I.Buff1
|        DREFIB1 SPWR 1                    DREFIB1
|   Const  R02845  R01036   Const           R02845
+[   A SUBX  B  =     C ]-[   A      MOVE       B ]-                    (  )
|  +01638                  +01638
|
|  << RUNG   82 >>
|
|  Drag    Drag    Drag    Drag
| Joystck Joystck MastrSw MastrSw
| Payout   Input  LoDeadB O.Delta
| PAYOUTM  DMSIN  DMSLODB DMSODEL
| 03-0904  R07028  R02821  R02829
+--] [---[   A SUBX  B  =    C ]-                                        (  )
|     77
|
|  << RUNG   83 >>
|
|  Drag            Drg Pay          Drg Pay           Drag    Drag   Ref'nce
| MastrSw           Temp              Temp           Mast.SW Ref'nce Working
| O.Delta           DBPrec            DBPrec         I.Span  I.Buff1 Reg'ter
| DMSODEL           DMSWR2            DMSWR2         DMSOSPN DREFOB1  REFWR
|  R02829   Const  R02847            R02847          R02818  R02849  R02833
+[   A MPY   B  =     C          ]-[   A    DVD         B      QUO      REM ]-  (  )
|          +01638
|
|  << RUNG   84 >>
|
|  Drag            SglPrec                   Drag
| Ref'nce          Working                  Ref'nce
| I.Buff1          Reg'ter                  I.Buff1
| DREFOB1          SPWR 1                   DREFOB1
|  R02849   Const  R01036   Const           R02849
+[   A SUBX  B  =     C ]-[   A      MOVE       B ]-                    (  )
|          -01638           -01638
|
|  << RUNG   85 >>
|
|  Drag    Drag            Drag
| Joystck Ref'nce         Refrnce
|  Drag   I.Buff1         Counts
| DRAGMS  DREFIB1         DREFCNT
| 03-0903  R02845          R02473
+--] [---[   A      MOVE       B ]-                                      (  )
|     76
|
|  << RUNG   86 >>
|
|  Drag    Drag            Drag
| Joystck Ref'nce         Refrnce
| Payout  I.Buff1         Counts
| PAYOUTM DREFOB1         DREFCNT
| 03-0904  R02849          R02473
+--] [---[   A      MOVE       B ]-                                      (  )
|     77
|
```


RUNG 117
Hoist Loop Ovr'cur HLOC I0737
Hoist CurIsol Loss HCILOS I0739
Hoist Gen.Fld Not OC HGFOC I0033
Hoist Field Loss HFLX I0113
Hst.Gen Ovr-Vlt Latch HOVL 00-0693
168
PowerUp Reset Counter RSETCTR 00960
Drive Reset P.B. DRRSTPB I0005
Hoist Drive Fault HDFR 00-0194
184
117
Hoist Drive Fault HDFR 00-0194
Cross reference for 00- 0194
117
118
RUNG 118
Hoist Brake Release HBR 00-0211
Not Hst Shut Dn Relay HSCR 02-0895
Sft'wre LineExc Aux'ary LEX 03-0049
Hoist Drive Fault HDFR 00-0194
112
Boom Rse/Lwr Mode BRLMODE A00911
197
32
117
Hoist Gen.Fld DB Aux HDBAUX 00-0195
Cross reference for 00- 0195
122

```
<< RUNG  140 >>

 Swing    M/G   Swg.Brk                                                  Swing   Cross reference for 00124
Brake#1   Set    Alarm                                                  Brake
PressSw Running  Timer                                                 Set Lt.
SBRKPS1  MGRUN  SBRKTMR                                                 SBIL
 I0226  03-0055 00-0182                                                 00124
+--]/[--+--] [--+--]/[--+-----------------------------------------------( )
|       |  240  |  149  |
| Swing |       | Light |
|Brake#2|       |  On   |
|PressSw|       |Flasher|
|SBRKPS2|       |FLASH1 |
| I0195 |       |00-0740|
+--]/[--+       +--] [--+
|                  179  |
|LampTst                |
|w/Alarm                |
|ClearPB                |
|LMPTEST                |
|A00909                 |
+--] [------------------+
|  357
|
|<< RUNG  141 >>
|
|  .....................................................................
|  .                                                                   .
|  .    Operation of the drag brake magnet valve is subject to logic similar to .
|  . that of the hoist drive. Special brake control is availiable in the       .
|  . Boom Raise/Lower Mode.                                            .
|  .                                                                   .
|  .....................................................................
|
| Drag    Drag    Drag    Drag    Drag    Drag                          Drag    Cross reference for 00012
|Gen.Fld Clutch  DB Cont Gen.Fld Gen.Fld  Brake                         Brake
|DB Cont PressSw Int'lck AC Cont FuseLss Release                        Mag.Vlv  ] [  150, 515
|  DDB   DCLTPS   DDBX    DALEX  DGFFLSS   DBR                         DBMV
| 00003   I0199   I0040   I0163   I0030  00-0212                       00012
+--] [-----] [-----] [-----] [-----] [-----] [--------------------------( )
|  136                                 113
|
|<< RUNG  142 >>
|
|  .....................................................................
|  .                                                                   .
|  . Next two rungs are used for OIT purposes; the Boom Raise/Lower Screen.    .
|  . R-941 and R-942 are transferred to the OIT for display.           .
|  .                                                                   .
|  .....................................................................
|
| Hoist                                                                 Hoist   Cross reference for A00305
| Brake                                                                BrkeSet
|Mag.Vlv                                                               1-Shot   ] [  143
| HBMV                                                                 HBSET1S
| 00011                                                                A00305
+--]/[-----------------------------------------------------------------(OS)
|  137
|
|<< RUNG  143 >>
|
| Hoist   Boom    Hoist          Hoist
|BrkeSet Rse/Lwr  Arm.          Current
|1-Shot   Mode    Amps.         Feedbck
|HBSET1S BRLMODE HCFBAMP        HCFBLP
|A00305  A00911   R02344         R00941
+--] [-----] [---[   A     MOVE      B ]-                                ( )
|  142     197
```

```
<< RUNG  175 >>

*****************************************************************************
*                                                                           *
*                    BEGIN PROGRAM HOUSEKEEPING LOGIC                       *
*                                                                           *
*****************************************************************************




+[NO OP]-                                                          (  )

<< RUNG  176 >>

Sft'wre  Reset                                                      LE On   Cross reference for 00- 0351
LineExc  LE On                                                      One
Aux'ary 1-Shot                                                      Shot    ] [  360
  LEX   LEOSRST                                                     LEONOS
03-0049 00-0352                                                     00-0351
+--] [-----]/[-------------------------------------------------------(  )
   32     177

<< RUNG  177 >>

Sft'wre                                                             Reset   Cross reference for 00- 0352
LineExc                                                             LE On
Aux'ary                                                             1-Shot  ]/[  176
  LEX                                                               LEOSRST
03-0049                                                             00-0352
+--] [-------------------------------------------------------------(  )
   32

<< RUNG  178 >>

.............................................................................
.                                                                           .
.    At times, the software logic may require use of an interlock which is  .
. never subjected to a change of state. This rung provides such a function  .
. for general purpose use by the programmer.                                .
.                                                                           .
.............................................................................

Never   Never                                                       Never   Cross reference for 00- 0254
Ener-   Ener-                                                      Ener-
gized   gized                                                       gized   ] [  5, 178, 268, 276, 279, 444,
EVEROFF EVEROFF                                                     EVEROFF       460, 512, 536, 538, 539, 54
00-0254 00-0254                                                     00-0254       639, 640, 642, 646
+--] [-----]/[-------------------------------------------------------(  )   ]/[  28, 178, 225, 250, 252, 264
   178     178

<< RUNG  179 >>

Reset                                                               Light   Cross reference for 00- 0740
Light                                                               On
Flasher                                                             Flasher ] [  138, 140, 144, 147, 180, 35
FLASH2                                                              FLASH1
00-0741                                                       Const 00-0740
+--]/[-------------------------------------------------------[PRESC]---(TT)
   180                                                          004    (  )
Reset                                                         LightOn  (  )
Light                                                         Flasher  (  )
Flasher                                                       AccTime  (  )
FLASH2                                                        ONFLSHT  (  )
00-0741                                                       R01084   (  )
+--] [-------------------------------------------------------[ACCRG]---( R)
   180
```


<< RUNG 214 >>
DOL Select Latch
DOL SEL
O3-0076
SyncMtr Contctr #1Closd
SYM1CC
I0098
Field#1 Contctr ClsdRly
FLD1CCR
I0100
M/G Set Startng Ind.Lt.
STRTING
00347
Cross reference for 00347
208
MG Set Start Latch
MGSTLAT
O3-0050
228
M/G Set Start CyclePB
STRTCYC
I0068
<< RUNG 215 >>
SyncMtr Contctr #1Closd
SYM1CC
I0098
SyncMtr Field
ApplDIL
SYMFALT
00346
M/G Set Running
MGRUN
O3-0055
M/G Set Started Ind.Lt.
STARTED
00348
Cross reference for 00348
217
240
M/G Set Start CyclePB
STRTCYC
I0068
<< RUNG 216 >>
SyncMtr Contctr #1Closd
SYM1CC
I0098
VacBrkr Closed Ind.Lt.
VCBLT
00345
Cross reference for 00345
M/G Set Start CyclePB
STRTCYC
I0068

```
|
|  << RUNG  248 >>
|
|Synchro                                                          Synchro  Cross reference for A00333
| Card                                                            Card ON
| "ON"                                                            OIT Aux
|SYCHRON                                                          CARDONX
| O0794                                                           A00333
+--]/[-----------------------------------------------------------------(  )
|
|
|  << RUNG  249 >>
|
|SS/Sync                                                          SS/Sync  Cross reference for A00334
| Motor                                                           MotrPCM
|PCM Flt                                                          Flt Aux
|PCMFLT                                                           PCMTRIP
| I0761                                                           A00334
+--] [-----------------------------------------------------------------(  )
|
```

```
 << RUNG  275 >>

 .....................................................................
 .                                                                   .
 .   Next few rungs determine that the CPU is in a power up situation. This   .
 . signal will activate an OIT Reset and automatic update of the CPU date    .
 . and time.                                                         .
 .                                                                   .
 .....................................................................

 Power                  OIT
  Up                   Transfr
 Scan                  Reg. 2
PUPSCAN                OITREG2
 00950    Const         R00997
+--]/[---[   A     MOVE      B ]-                                    ( )
   282   +00000

 << RUNG  276 >>

 Never                  OIT                                          OIT    Cross reference for A00910
 Ener-                 Transfr                                     PowerUp
 gized                 Reg. 2                                      Acknowl  ] [  278
EVEROFF                OITREG2                                     POWERUP  ]/[  277
00-0254   Const         R00997  Const                               A00910
+--] [---[ BIT   SET    MATRIX      LEN]-----------------------------------( )
   178    00002                    001

 << RUNG  277 >>

 Power    OIT                    OIT
  Up    PowerUp                Transfr
 Scan   Acknowl                Reg. 1
PUPSCAN POWERUP                OITREG1
 00950  A00910    Const         R00999  Const
+--] [-----]/[---[ BIT   SET    MATRIX      LEN]-                       ( )
   282     276    00002                    001

 << RUNG  278 >>

  OIT                   OIT
PowerUp                Transfr
Acknowl                Reg. 1
POWERUP                OITREG1
A00910    Const         R00999  Const
+--] [---[ BIT  CLEAR   MATRIX      LEN]-                              ( )
   276    00002                    001

 << RUNG  279 >>

 Never    All   Disabld
 Ener-  Zero's  Events
 gized  Matrix  Matrix
EVEROFF 0-MATRX OITSSDB
00-0254  R01700  R00701  Const
+--] [---[   A INV   B     LEN ]-                                     ( )
   178                     019
```

```
 << RUNG  312 >>

OpnGear          LubeSys        LubeSys                Open   LubeSys
Propel           Utility        Utility               Gear B  Utility
Int'val          Reg. 1         Reg. 1                Int'val Reg. 3
OGPINT           LSREG1         LSREG1                OGINTB  LSREG3
 R03677   Const  R01247          R01247          Const  R01204  R01249
+[   A MPY   B  =    C        ]-[   A    DVD        B     QUO     REM ]-  (  )
         +00060                                   +00001

 << RUNG  313 >>

FrntEnd          LubeSys        LubeSys                FrntEnd LubeSys
  Dig            Utility        Utility               Int. A  Utility
Int'val          Reg. 1         Reg. 1                Aux'ary Reg. 3
LFDINT           LSREG1         LSREG1                FEINTA  LSREG3
 R03680   Const  R01247          R01247          Const  R01205  R01249
+[   A MPY   B  =    C        ]-[   A    DVD        B     QUO     REM ]-  (  )
         +00060                                   +00001

 << RUNG  314 >>

Rotatng          LubeSys        LubeSys                Rotatng LubeSys
 Frame           Utility        Utility                 Frame  Utility
Int'val          Reg. 1         Reg. 1                Int'val Reg. 3
 RFINT           LSREG1         LSREG1                 RFINT  LSREG3
 R01202   Const  R01247          R01247          Const  R01202  R01249
+[   A MPY   B  =    C        ]-[   A    DVD        B     QUO     REM ]-  (  )
         +00060                                   +00001

 << RUNG  315 >>

Low.Frm          Grease
Grs.Gun            Gun
Manual            Time
LFGGMAN          GUNTIME
 R03681           R01206
+[   A     MOVE      B ]-                                                 (  )

 << RUNG  316 >>

Grease           LubeSys        LubeSys                Grease  LubeSys
  Gun            Utility        Utility                 Gun    Utility
 Time            Reg. 1         Reg. 1                 Time   Reg. 3
GUNTIME          LSREG1         LSREG1                GUNTIME LSREG3
 R01206   Const  R01247          R01247          Const  R01206  R01249
+[   A MPY   B  =    C        ]-[   A    DVD        B     QUO     REM ]-  (  )
         +00060                                   +00001
```

```
 |
 | << RUNG  346 >>
 |
 | Front                                                           FrntEnd  Cross reference for 00- 0376
 |  End                                                            1-Shot
 |Valve A                                                           Reset   ]/[  345
 |FEVALVA                                                           LFOSR
 | 00514                                                           00-0376
 +--] [-------------------------------------------------------------( )
 |   349
 |
 | << RUNG  347 >>
 |
 | Front                                                   FrntEnd FrntEnd  Cross reference for 00- 0377
 |  End                                                     Fault   Fault
 |AirPump                                                   Time    Timer   ] [  347, 353
 |FE PUMP                                                  FEFLTTM LFFTMR   ]/[  347, 349
 | 00513                                                   R03683  00-0377
 +--] [--------------------------------------------------[PRERG]---(TS)
 |   350                                                           ( )
 | Front  FrntEnd                                          FrntEnd  ( )
 |  End    Fault                                            Fault   ( )
 |P.S. A   Timer                                           Time 1   ( )
 | FEPSA  LFFTMR                                            LFFTM   ( )
 | 10483  00-0377                                          R01220   ( )
 +--] [-----]/[--+-----------------------------------------[ACCRG]---( R)
 |           347 |
 | Lube   FrntEnd|
 | Fault   Fault |
 |ResetPB  Timer |
 |LFLTRST LFFTMR |
 | 10488  00-0377|
 +--] [-----] [--+
 |           347
 |
 | << RUNG  348 >>
 |
 |                                                                 FrntEnd  Cross reference for 00- 0378
 |                                                                 PSFault
 |                                                                  Timer   ] [  348, 353
 |                                                                 LFPSFLT  ]/[  348, 349
 |                                                          Const  00-0378
 +-------------------------------------------------------[PRESC]---(TS)
 |                                                           060    ( )
 | Front  FrntEnd                                          FrntEnd  ( )
 |  End   PSFault                                           Fault   ( )
 |P.S. A   Timer                                           Time 2   ( )
 | FEPSA  LFPSFLT                                          FEF2TM   ( )
 | 10483  00-0378                                          R01221   ( )
 +--]/[-----]/[--+-----------------------------------------[ACCRG]---( R)
 |           348 |
 | Lube   FrntEnd|
 | Fault  PSFault|
 |ResetPB  Timer |
 |LFLTRST LFPSFLT|
 | 10488  00-0378|
 +--] [-----] [--+
 |           348
```

```
|
| << RUNG  375 >>
|
|Set Pt. Multi-          Set Pt.  Value                  Set Pt.
|Trn'fer purpose          Table    Not                    Table
| Latch   Relay          Pointer  Req'd                  Pointer
| SPLAT   MPR2            SPPTR  NOTREQD                  SPPTR
|03-0064 00-0101   Const  R02450  R00769   Const         R02450
+--] [-----] [---[   A SUBX  B  =    C ]-[   A     MOVE      B ]-          (  )
|   370     371   +03750                 +03451
|
| << RUNG  376 >>
|
| ********************************************************************************
| *                                                                              *
| *                          END SUBROUTINE NUMBER 5                             *
| *                                                                              *
| ********************************************************************************
|
|
|
|
|
+[   Return    ]-
|
```

```
 << RUNG  423 >>

       Aux'ary SglPrec          Aux'ary Aux'ary
        Month  Working          Day of  Day of
       of Year Reg'ter           Year    Year
       AUXMNTH SPWREG           AUXDOY  AUXDOY
  Const  R00916  R00915   Const  R00918  R00918
+[   A SUBX  B  =    C ]-[   A ADDX  B  =    C ]-                        (  )
 +00012                 +00030

 << RUNG  424 >>

 ..............................................................................
 .                                                                            .
 . The following rung produces a number equal to the current hundreds of      .
 . days.                                                                      .
 .                                                                            .
 ..............................................................................

Aux'ary          DblPrec         DblPrec                  Hund-  DblPrec
Day of           Working         Working                  reds   Working
 Year            Reg'ter         Reg'ter                of Days Reg'ter
AUXDOY           DPWREG          DPWREG                 DAY/100 DPWREG
 R00918   Const  R00914           R00914           Const  R00919  R00914
+[   A MPY   B  =    C         ]-[   A    DVD        B     QUO     REM ]-  (  )
         +00001                                   +00100

 << RUNG  425 >>

 ..............................................................................
 .                                                                            .
 . The following rung produces a number equal to the current day of the year  .
 . minus the hundreds of days.                                                .
 .                                                                            .
 ..............................................................................

 Hund-           DblPrec         Aux'ary DblPrec Single
 reds            Working         Day of  Working  Days
of Days          Reg'ter          Year   Reg'ter Reg'ter
DAY/100          DPWREG          AUXDOY  DPWREG  SGLDAYS
 R00919   Const  R00914           R00918  R00914  R00920
+[   A MPY   B  =    C         ]-[   A SUBX  B  =    C ]-                 (  )
         +00100

 << RUNG  426 >>

 ..............................................................................
 .                                                                            .
 . The next rung converts decimal Single Days to BCD for compatibility with   .
 . the CPU clock.                                                             .
 .                                                                            .
 ..............................................................................

Single  General
 Days   Working
Reg'ter   I/O
SGLDAYS GENWI/O
 R0920   00897
+[ BIN  TO BCD ]-                                                            (  )
```

```
|
|  << RUNG  481 >>
|
|SyncMtr                                                          SyncMtr  Cross reference for A00095
|Stator                                                           Stator
|OT Bit                                                           O'Temp.
|2074B16                                                          SYMSOT
|00-0416                                                          A00095
+--] [-----------------------------------------------------------------( )
|
|
|  << RUNG  482 >>
|
|Center                                                           Center   Cross reference for A00096
|Journal                                                          Journal
|OT Bit                                                           O'Temp.
|2075B01                                                          CNTRJOT
|00-0417                                                          A00096
+--] [-----------------------------------------------------------------( )
|
|
|  << RUNG  483 >>
|
| House                                                            House   Cross reference for A00097
|Ambient                                                          Ambient
|OT Bit                                                           O'Temp.
|2075B02                                                          HOUSEOT
|00-0418                                                          A00097
+--] [-----------------------------------------------------------------( )
|
|
|  << RUNG  484 >>
|
|  PCR                                                              PCR    Cross reference for A00098
|Ambient                                                          Ambient
|OT Bit                                                           O'Temp.
|2075B03                                                          PCR OT
|00-0419                                                          A00098
+--] [-----------------------------------------------------------------( )
|
|
|  << RUNG  485 >>
|
|PropLft                                                          PropLft  Cross reference for A00099
|Outb'rd                                                          Outb'rd
|Bearing                                                          Brng OT
|2075B04                                                          PLOBOT
|00-0420                                                          A00099
+--] [-----------------------------------------------------------------( )
|
|
|  << RUNG  486 >>
|
|PropLft                                                          PropLft  Cross reference for A00100
|Inboard                                                          Inboard
|Bearing                                                          Brng OT
|2075B05                                                          PLIBOT
|00-0421                                                          A00100
+--] [-----------------------------------------------------------------( )
|
|
|  << RUNG  487 >>
|
| Swing                                                           Swg Lwr  Cross reference for A00101
| Lower                                                           Brng #1
|Brng #1                                                          O'Temp.
|2075B06                                                          SLB1OT
|00-0422                                                          A00101
+--] [-----------------------------------------------------------------( )
|
```

```
|
|  << RUNG  535 >>
|
|  Drag    MG Set                                                          Drag     Cross reference for A00238
| Loop #2   Start                                                         Loop #2
| Ovr'cur   Latch                                                         O'Crrnt
|  DL20C   MGSTLAT                                                        DL20'C
|  I0747   03-0050                                                        A00238
+--] [--+--] [--+-------------------------------------------------[LATCH]---( L)
|       |    228 |                                                          (  )
|       |Sft'wre |                                                          (  )
|       |LineExc |                                                          (  )
|       |Aux'ary |                                                          (  )
|       |  LEX   |                                                          (  )
|       |03-0049 |                                                          (  )
+       +--] [--+                                                          (  )
|           32                                                            (  )
|  Drive                                                                  (  )
|  Reset                                                                  (  )
|  P.B.                                                                   (  )
| DRRSTPB                                                                 (  )
|  I0005                                                                  (  )
+--] [-----------------------------------------------------------------------(UL)
|
|
|  << RUNG  536 >>
|
|  Never                                                                  M/G Set  Cross reference for A00239
|  Ener-                                                                  Rev.Rot
|  gized                                                                   Trip
| EVEROFF                                                                 REVROTT
| 00-0254                                                                 A00239
+--] [-----------------------------------------------------------------------(  )
|    178
|
|  << RUNG  537 >>
|
|   M/G    M/G Set          Value                                         M/G Set  Cross reference for A00240
|   Set     Speed            Not                                          TachLss
| Running   Input           Req'd                                          Trip    ] [  585
|  MGRUN   SPEEDIN         NOTREQD                                        TACHLSS
| 03-0055   R07033   Const  R00769                                        A00240
+--] [---[   A SUBX  B  =     C ]-------------------------------------------(  )
|    240           +00001
|
|  << RUNG  538 >>
|
|  Never                                                                  Startng  Cross reference for A00241
|  Ener-                                                                   Motor
|  gized                                                                  O'Voltg
| EVEROFF                                                                 STMO'V
| 00-0254                                                                 A00241
+--] [-----------------------------------------------------------------------(  )
|    178
|
|  << RUNG  539 >>
|
|  Never                                                                   Hoist   Cross reference for A00242
|  Ener-                                                                   Stall
|  gized                                                                   Timer
| EVEROFF                                                                 HSTSTLL
| 00-0254                                                                 A00242
+--] [-----------------------------------------------------------------------(  )
|    178
```

```
 << RUNG  581 >>

SensBus                 Drag
Cntrllr                 Brake
OK Timr                 PressSw
SBOKTMR                 DBRKPS
A00704    Const           I0193  Const
+--] [---[ BIT  CLEAR   MATRIX      LEN]-                              (  )
    23    00016                     001

 << RUNG  582 >>

SensBus SensBus                                                        SensBus  Cross reference for A00739
Cntrllr Drop#3                                                         Drop #3
OK Timr Input16                                                        BlckFlt  ] [  225
SBOKTMR SB3IN16                                                        SNSDR03
A00704   I0224                                                        A00739
+--] [-----]/[-------------------------------------------------------------(  )
    23

 << RUNG  583 >>

SensBus                 Drag
Cntrllr                 Motor#1
OK Timr                 Klixon
SBOKTMR                 DM1OTX
A00704    Const           I0209  Const
+--] [---[ BIT  CLEAR   MATRIX      LEN]-                              (  )
    23    00016                     001

 << RUNG  584 >>

SensBus SensBus                                                        SensBus  Cross reference for A00740
Genius   Block                                                         Drop #4
 Fault  Address                                                        BlckFlt
SBGBFLT SNSBLCK                                                        SNSDR04
A00859   R00935   Const                                               A00740
+--] [---[  A EQUAL B  ]-------------------------------------[LATCH]---( L)
   578          +00393                                                 (  )
 Drive                                                                 (  )
 Reset                                                                 (  )
 P.B.                                                                  (  )
DRRSTPB                                                                (  )
 I0005                                                                 (  )
+--] [-------------------------------------------------------------------(UL)


 << RUNG  585 >>

M/G Set                                                                SensBus  Cross reference for A00741
TachLss                                                                Drop #5
 Trip                                                                  BlckFlt  ] [  225
TACHLSS                                                                SNSDR05
A00240                                                                 A00741
+--] [-------------------------------------------------------------------(  )
   537

 << RUNG  586 >>

Propel                                                                 SensBus  Cross reference for A00742
 Right                                                                 Drop #6
 Outer                                                                 BlckFlt
PROUTER                                                                SNSDR06
 R07001   Const                                                        A00742
+[  A EQUAL B  ]-----------------------------------------------------------(  )
         +10000
```

```
 << RUNG  628 >>

CntlBus CntlBus                                                        CntlBus  Cross reference for A00794
Genius   Block                                                         Drop#26
 Fault  Address                                                        BlckFlt
CBGFLT  CNTBLCK                                                        CNTDR26
A00863   R00937   Const                                               A00794
+--] [---[  A EQUAL B  ]-----------------------------------------[LATCH]---( L)
   594           +00529                                                  (  )
 Drive                                                                   (  )
 Reset                                                                   (  )
 P.B.                                                                    (  )
DRRSTPB                                                                  (  )
 I0005                                                                   (  )
+--] [-------------------------------------------------------------------(UL)


 << RUNG  629 >>

 ********************************************************************************
 *                                                                              *
 *                          END OF SUBROUTINE NUMBER 8                          *
 *                                                                              *
 ********************************************************************************




+[   Return    ]-
```

```
*
* << RUNG  666 >>
*
*
*
*   2048 = 8 in the upper byte of R4116.
*
*
*
*       Aux'ary SglPrec                 Month  Aux'ary          Day
*       Day of  Working                  and   Day of           of
*        Year   Reg'ter                  Day    Year           Month
*       AUXDOY  SPWREG                  DATE   AUXDOY         DAYMNTH
*  Const  R00918  R00915   Const        R04116  R00918   Const  R00924
+[   A SUBX  B  =    C ]-[   A     MOVE      B ]-[   A SUBX  B  =    C ]-  (  )
* +00213                 +02048                        +00212
*
* << RUNG  667 >>
*
*
*
*   2304 = 9 in the upper byte of R4116.
*
*
*
*       Aux'ary SglPrec                 Month  Aux'ary          Day
*       Day of  Working                  and   Day of           of
*        Year   Reg'ter                  Day    Year           Month
*       AUXDOY  SPWREG                  DATE   AUXDOY         DAYMNTH
*  Const  R00918  R00915   Const        R04116  R00918   Const  R00924
+[   A SUBX  B  =    C ]-[   A     MOVE      B ]-[   A SUBX  B  =    C ]-  (  )
* +00244                 +02304                        +00243
*
* << RUNG  668 >>
*
*
*
*   2560 = 10 in the upper byte of R4116.
*
*
*
*       Aux'ary SglPrec                 Month  Aux'ary          Day
*       Day of  Working                  and   Day of           of
*        Year   Reg'ter                  Day    Year           Month
*       AUXDOY  SPWREG                  DATE   AUXDOY         DAYMNTH
*  Const  R00918  R00915   Const        R04116  R00918   Const  R00924
+[   A SUBX  B  =    C ]-[   A     MOVE      B ]-[   A SUBX  B  =    C ]-  (  )
* +00274                 +02560                        +00273
*
* << RUNG  669 >>
*
*
*
*   2816 = 11 in the upper byte of R4116.
*
*
*
*       Aux'ary SglPrec                 Month  Aux'ary          Day
*       Day of  Working                  and   Day of           of
*        Year   Reg'ter                  Day    Year           Month
*       AUXDOY  SPWREG                  DATE   AUXDOY         DAYMNTH
*  Const  R00918  R00915   Const        R04116  R00918   Const  R00924
+[   A SUBX  B  =    C ]-[   A     MOVE      B ]-[   A SUBX  B  =    C ]-  (  )
* +00305                 +02816                        +00304
```

```
 << RUNG  700 >>

 .....................................................................
 .                                                                   .
 .    The input at the neutral postion is determined.                .
 .                                                                   .
 .....................................................................

Mast.SW  Hoist          Hoist
Calib.  Joystck        Mast.Sw
ZeroSet  Input         Zero Pt
MSCALZS  HMSIN         HMSZERO
A00563   R07026        R02802
+--] [---[   A     MOVE      B ]-                                ( )
   697

 << RUNG  701 >>

 .....................................................................
 .                                                                   .
 .    The maximum and minumum input values are determined.           .
 .                                                                   .
 .....................................................................

Mast.SW  Hoist   Hoist  SglPrec  Hoist          Hoist
Calib.  Mast.SW Joystck Working Joystck        Mast.SW
Max/Min Max.Ref  Input  Reg'ter  Input         Max.Ref
MSCALMM HMSMAX   HMSIN  SPWR 1   HMSIN         HMSMAX
A00564   R02800  R07026  R01036  R07026         R02800
+--] [---[   A SUBX  B  =    C ]-[   A     MOVE      B ]-          ( )
   698

 << RUNG  702 >>

Mast.SW  Hoist   Hoist  SglPrec  Hoist          Hoist
Calib.  Joystck MastrSw Working Joystck        MastrSw
Max/Min  Input  Min.Ref Reg'ter  Input         Min.Ref
MSCALMM  HMSIN  HMSMIN  SPWR 1   HMSIN         HMSMIN
A00564   R07026  R02801  R01036  R07026         R02801
+--] [---[   A SUBX  B  =    C ]-[   A     MOVE      B ]-          ( )
   698

 << RUNG  703 >>

 .....................................................................
 .                                                                   .
 .    The dead band around neutral is established.                   .
 .                                                                   .
 .....................................................................

Mast.SW  Hoist          Hoist
Calib.  Mast.Sw        MastrSw
Max/Min Zero Pt        HiDeadB
MSCALMM HMSZERO        HMSHIDB
A00564   R02802   Const  R02809
+--] [---[   A ADDX  B  =    C ]-                                ( )
   698          +00061

 << RUNG  704 >>

Mast.SW  Hoist          Hoist
Calib.  Mast.Sw        Mast.SW
Max/Min Zero Pt        LoDeadB
MSCALMM HMSZERO        HMSLODB
A00564   R02802   Const  R02810
+--] [---[   A SUBX  B  =    C ]-                                ( )
   698          +00061
```

***** I N P U T S T A T U S T A B L E *****

INPUT/ (OVR)	NAME/ NICKNAME	CROSS REFERENCE
I0065	MG Set1 : Start P.B. STRTMG1	] [228, 234 MNE 602
I0066	MG Set1 : Stop P.B. STOPMG1	] [235]/[235
I0067	DOL/ : SftStrt KeySw. DOL/SS	] [208]/[232
I0068	M/G Set : Start CyclePB STRTCYC	] [45, 47, 49, 51, 55, 59, 60, 213, 214, 215, 216, 217
I0069	DC Motr : Blowers StartPB STRTBLW	] [44
I0070	DC Motr : Blowers Stop PB STOPBLW	] [44
I0071	Oil : Pump StartPB STRTPMP	] [46, 48
I0072	Oil : Pump Stop PB STOPPMP	] [46, 48
I0073	Filter : Fan #1 StartPB STRTFF1	] [50
I0074	Filter : Fan #1 Stop PB STOPFF1	] [50, 53
I0075	Filter : Fan #2 StartPB STRTFF2	] [54
I0076	Filter : Fan #2 Stop PB STOPFF2	] [54, 57
I0077	AntiCnd : Heaters OFF/AUT ACHSSW	] [58

***** I N P U T S T A T U S T A B L E *****

INPUT/ (OVR)	NAME/ NICKNAME	CROSS REFERENCE
I0251	Altern. : Earth Fault ALT.E/F	] [495
I0252	Lgt/Pwr : Board B AV3.E/F L/PBBEF	] [498
I0481	Open : Gear P.S. A OGPSA	] [324]/[325, 326
I0482	Open : Gear P.S. B OGPSB	] [324]/[325, 327
I0483	Front : End P.S. A FEPSA	] [347]/[348, 349
I0484	Rotatng : Frame P.S. A RFPSA	] [332]/[333, 334
I0485	Rotatng : Frame P.S. B RFPSB	] [332]/[333, 335
I0486	Rotatng : Frame P.S.A/B RFPSA/B	] [332]/[333, 334, 335
I0487	HIBS : Pressur Switch HIBS PS	]/[458
I0488	Lube : Fault ResetPB LFLTRST	] [307, 308, 324, 325, 332, 333, 347, 348, 351, 352, 353, 354]/[439, 440, 441, 442
I0489	Manual : Propel Mode PB MANPROP	] [306, 308, 327, 335]/[326, 334
I0490	OpnGear : Manual StartPB OGSTART	] [326, 327
I0491	FrntEnd : Manual StartPB FESTART	] [349

***** O U T P U T S T A T U S T A B L E *****

OUTPUT/ (OVR)	NAME/ NICKNAME	CROSS REFERENCE
00515	FrntEnd : /GrsGun Valve B FEVALVB	] [343, 344, 350]/[344, 349 ( ) 343
00517	Rotatng : Frame AirPump RF PUMP	] [332 ( ) 336
00518	Rotatng : Frame Valve A RFVALVA	] [330, 331, 334, 336]/[335 ( ) 334
00519	Rotatng : Frame Valve B RFVALVB	] [330, 331, 335, 336, 338]/[334 ( ) 335
00529	Machine : Operat- ing IL MOPERIL	( ) 307
00530	Propel : Mode Ind.Lt. PRPMDIL	( ) 308
00531	Front : End FaultIL FEFLTIL	] [439 ( ) 353
00532	Rotatng : Frame FaultIL RFFLTIL	] [440 ( ) 352
00533	Propel : Fault Ind.Lt. PRFLTIL	] [441 ( ) 354
00534	Open : Gear FaultIL OGFLTIL	] [442 ( ) 351
00578	Clear : Sensor BusFlts SENSBUS	( ) 281
00642	Clear : Control BusFlts CNTLBUS	( ) 280
00785	Disc'te : I/O 785 DIO-785	MNE 303

***** A U X O U T P U T S T A T U S T A B L E *****

AUX OUTPUT	NAME/ NICKNAME	CROSS REFERENCE
A00211	Hoist : Current LmtLoss HCLL	( ) 523
A00214	Drag : LoopGnd Fault DLGNDF	( ) 524
A00216	Drag : Current LmtLoss DCLL	( ) 525
A00217	Swing : LoopGnd Fault SLGNDF	( ) 526
A00225	Swing : Voltage LmtLoss SVLL	( ) 527
A00227	Hoist : Loop O'Crrnt HLO'C	(L) 528
A00228	Hoist : CurrIso Loss HCIL	(L) 529
A00231	Swing : Loop O'Crrnt SLO'C	(L) 530
A00232	Swing : CurrIso Loss SCIL	(L) 531
A00235	Drag : Loop #1 O'Crrnt DL1O'C	(L) 532
A00236	Drag : CurrIso Loss DCIL	(L) 533
A00237	Drag Lp : Unbalnc Inst.OC DLUIO'C	(L) 534

***** A U X O U T P U T S T A T U S T A B L E *****

AUX OUTPUT	NAME/ NICKNAME	CROSS REFERENCE
A00902	Sample : Temp at 06:00 TMP0600	] [399 (OS) 393
A00903	Sample : Temp at 10:00 TMP1000	] [400 (OS) 394
A00904	Sample : Temp at 14:00 TMP1400	] [401 (OS) 395
A00905	Sample : Temp at 18:00 TMP1800	] [402 (OS) 396
A00906	Sample : Temp at 22:00 TMP2200	] [403 (OS) 397
A00907	Clear : Event Logger CLRFLTS	]/[634 ( ) 632
A00908	Fresh : Event Counter FLTCNTR	(CU) 646
A00909	LampTst : w/Alarm ClearPB LMPTEST	] [138, 140, 144, 147, 358, 361, 362, 363, 364 (TS) 357
A00910	OIT : PowerUp Acknowl POWERUP	] [278]/[277 ( ) 276
A00911	Boom : Rse/Lwr Mode BRLMODE	] [73, 74, 118, 122, 143, 198]/[75, 129, 136, 137, 160, 204 (L) 197
A00912	Boom : Rse/Lwr Permiss BRLMAUX	] [197, 197 ( ) 196
A00913	Drg/Prp : Trn'fer Aux'ary DPTR	( ) 36

( ) = implicit references
MNE = mnemonic references

***** I N T E R N A L O U T P U T S T A T U S T A B L E *****

C H A N N E L N U M B E R 0-

INT OUTPUT	NAME/ NICKNAME	CROSS REFERENCE
0404	HstDrum : Shaft Right 2074B04	] [471
0405	DrgDrum : Shaft Right 2074B05	] [472
0408	MG Set1 : Bearing #1OTBit 2074B08	] [473
0409	MG Set1 : Bearing #2OTBit 2074B09	] [474
0410	MG Set1 : Bearing #3OTBit 2074B10	] [475
0411	MG Set1 : Bearing #4OTBit 2074B11	] [476
0412	MG Set1 : Bearing #5OTBit 2074B12	] [477
0413	MG Set1 : Bearing #6OTBit 2074B13	] [478
0414	MG Set1 : Bearing #7OTBit 2074B14	] [479
0415	MG Set1 : Bearing #8OTBit 2074B15	] [480
0416	SyncMtr : Stator OT Bit 2074B16	] [481
0417	Center : Journal OT Bit 2075B01	] [482
0418	House : Ambient OT Bit 2075B02	] [483

***** I N T E R N A L I N P U T S T A T U S T A B L E *****

C H A N N E L N U M B E R 2-

INT INPUT	NAME/ NICKNAME	CROSS REFERENCE

( ) = implicit references
MNE = mnemonic references

***** R E G I S T E R S T A T U S T A B L E *****

REGISTER/ VALUE	NAME/ NICKNAME	CROSS REFERENCE
R00001 [00832]	Event Matrix (S6+AO) FLTMATX	: 639, 643, 643, 644
R00047 [00000]	SensBus BadBlck Matrix SBMATRX	: 578
R00049 [00000]	CntlBus BadBlck Matrix1 CBMTRX1	: 594
R00050 [00000]	CntlBus BadBlck Matrix2 CBMTRX2	: 594
R00084 [00000]	Aux.Inp Status Reg'ter AISTAT1	: 158
R00604 [00000]	Drg/Ppl DB/LE AccTime FALTOFF	: 552
R00605 [00000]	Hoist DB/LE AccTime RTDFALT	: 553
R00606 [00000]	Main LE Permiss Time LEPERTM	: 554
R00607 [00000]	Swing DB/LE AccTime VCFLTR1	: 556
R00650 [00000]	AlrmClr /LmpTst AccTime TESTTME	: 357
R00701 [65535]	Disabld Events Matrix OITSSDB	: 279, 643
R00730 [01577]		: 17, 20
R00740 [01641]		: 22, 25

***** R E G I S T E R S T A T U S T A B L E *****

REGISTER/ VALUE	NAME/ NICKNAME	CROSS REFERENCE
R02342 [-00010]	Drag Arm. V. x 10 DVFBVLT	: 169, 170
R02343 [65471]	Swing Arm. V. x 10 SVFBVLT	: 172, 173
R02344 [00015]	Hoist Arm. Amps. HCFBAMP	: 143, 202, 203
R02349 [-00015]	DragGen Fld.Amp x 100 DMFAMP	: 693, 693
R02354 [00905]	Air Press. PSI x10 AIRPSI	: 250, 250
R02357 [00000]	PCM Output Current PCMCFB	: 230
R02358 [06521]	Machine AC Voltage VMACH	: 221, 223, 252, 252
R02364 [03590]	Propel Encoder Degrees PENCDEG	: 89, 89, 93, 93, 95
R02372 [26624]	Disc'te I/O 737-752 DISC#1	: 302
R02373 [61680]	Disc'te I/O 753-768 DISC#2	: 302
R02374 [29264]	Disc'te I/O 785-800 DISC#3	: 303
R02375 [00000]	DISC'TE I/O 49 - 64 DISC#4	: 303
R02391 [08617]	Calibr. Lower Limit CAL LL	: 11

***** R E G I S T E R S T A T U S T A B L E *****

REGISTER/ VALUE	NAME/ NICKNAME		CROSS REFERENCE
R07028 [03103]	Drag Joystck Input DMSIN	:	76, 77, 79, 82, 708, 709, 709, 710, 710
R07029 [03083]	Swing MastrSw Input SMSIN	:	99, 100, 102, 105, 716, 717, 717, 718, 718
R07033 [00499]	M/G Set Speed Input SPEEDIN	:	379, 379, 537

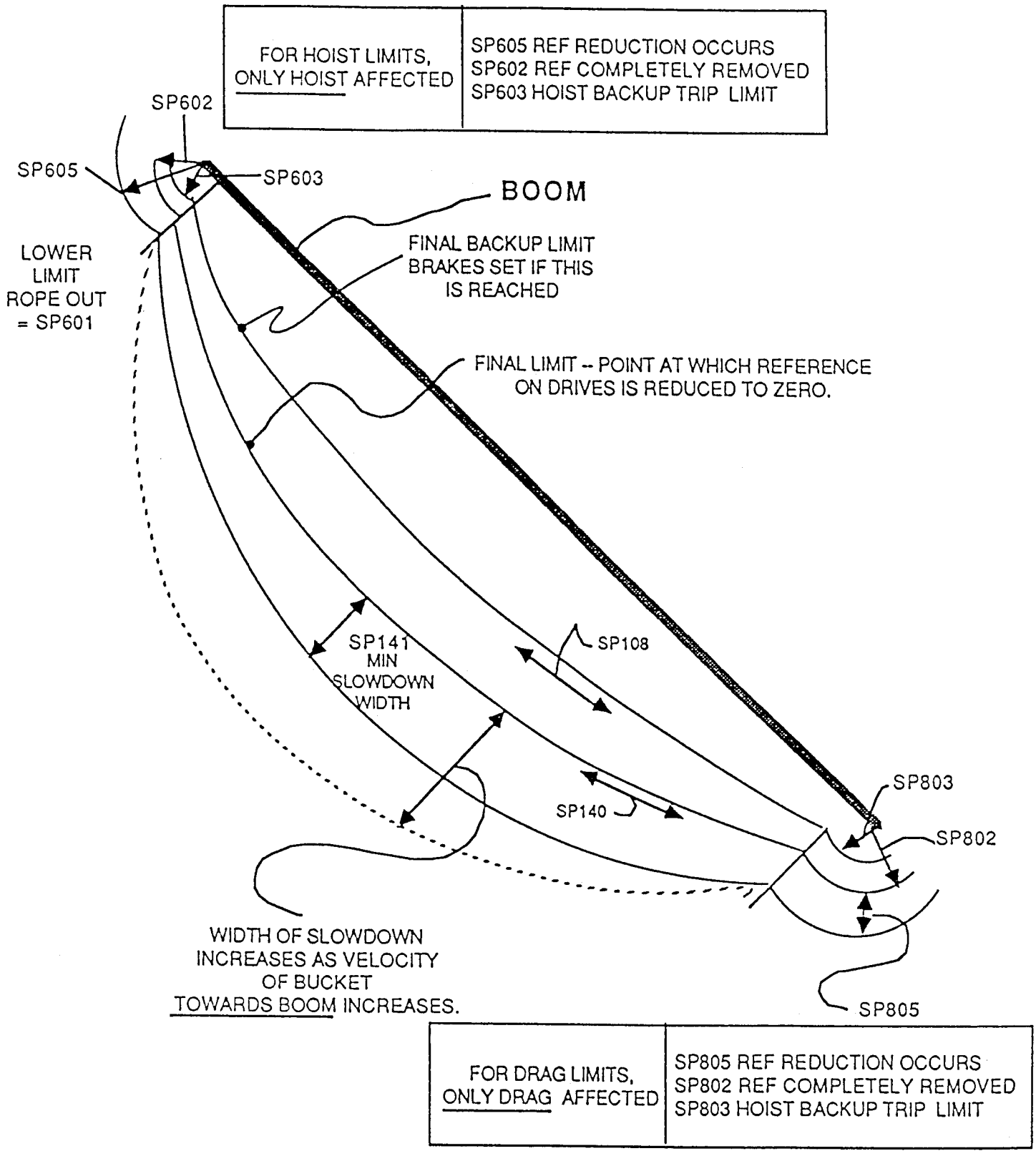
( ) = implicit references

SERIES SIX OIT SETPOINT CONVERSION SHEET

The Boom Protection System has codes that are relative to all Draglines using Thumbwheels to display and change setpoints. The Draglines equipped with OIT's (Operator Interface Terminal's) use Parameter Numbers as their codes. This sheet helps convert the OIT codes into the more conventional Boom Protection codes.

Setpoint	OIT Parameter #	PLC Register	Description
108	1	R-3651	Static Tightline Trip
140	2	R-3652	Static TL Zero Reference
141	3	R-3653	Width of TL Slowdown Zone
142	4	R-3654	Gain for TL Slowdown Zone
304	5	R-3655	Gain for Lower/Payout Limit Trip
601	6	R-3656	Lower Limit
602	7	R-3657	Hoist Limit Zero Reference
603	8	R-3658	Hoist Limit Trip
605	10	R-3660	Width of Hoist Limit Slowdown Zone
677	15	R-3665	Hoist Drum Diameter
N/A	9	R-3659	Width of Lower/Payout Slowdown Zones
801	11	R-3661	Drag Payout Limit
802	12	R-3662	Drag Limit Zero Reference
803	13	R-3663	Drag Limit Trip
804	14	R-3664	Width of Drag Limit Slowdown Zone
877	16	R-3666	Drag Drum Diameter

EFFECT OF ADJUSTMENTS ON SERIES SIX BOOM PROTECTION ACTION

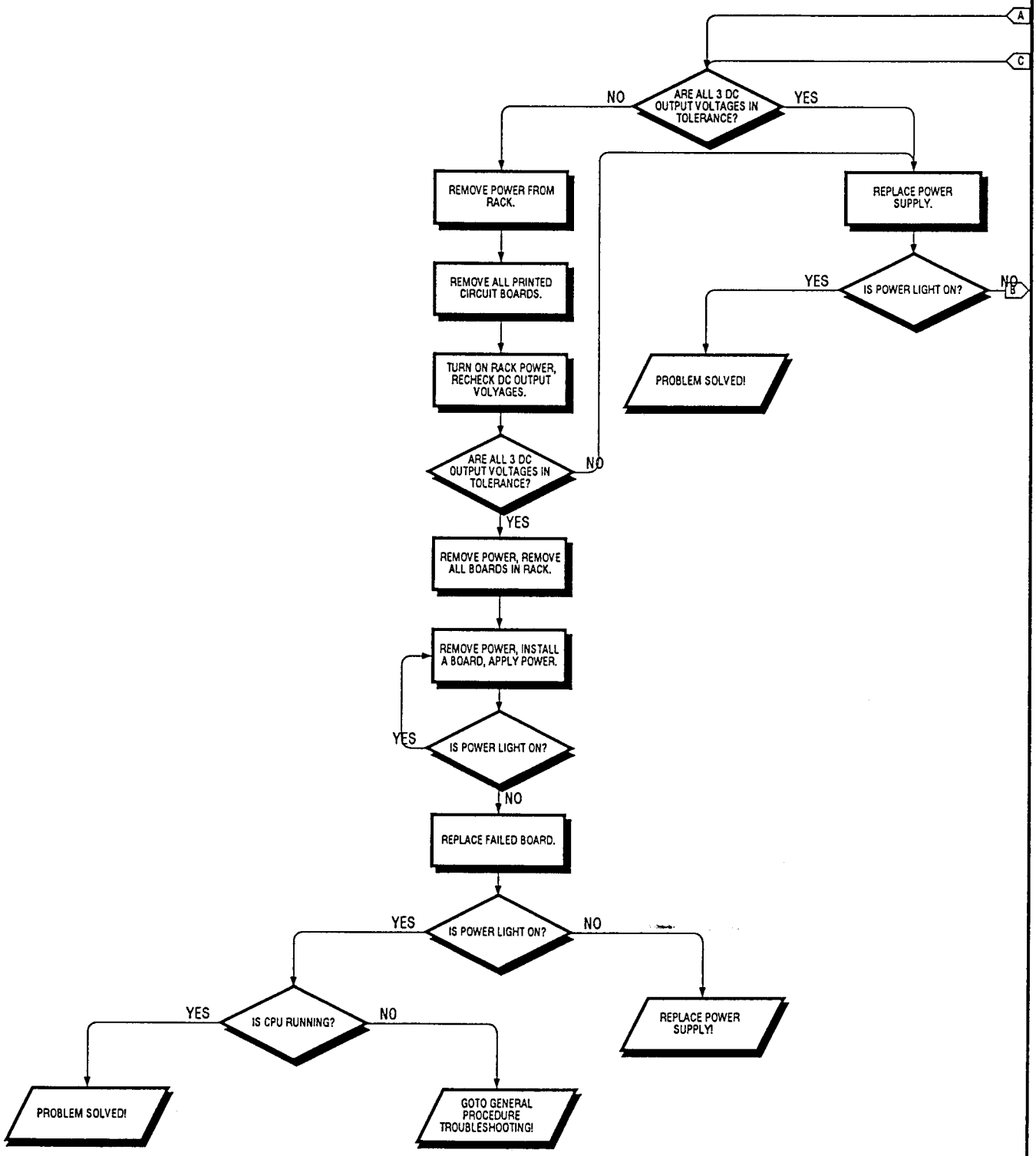


EFFECT OF ADJUSTMENTS ON SERIES SIX BOOM PROTECTION ACTION

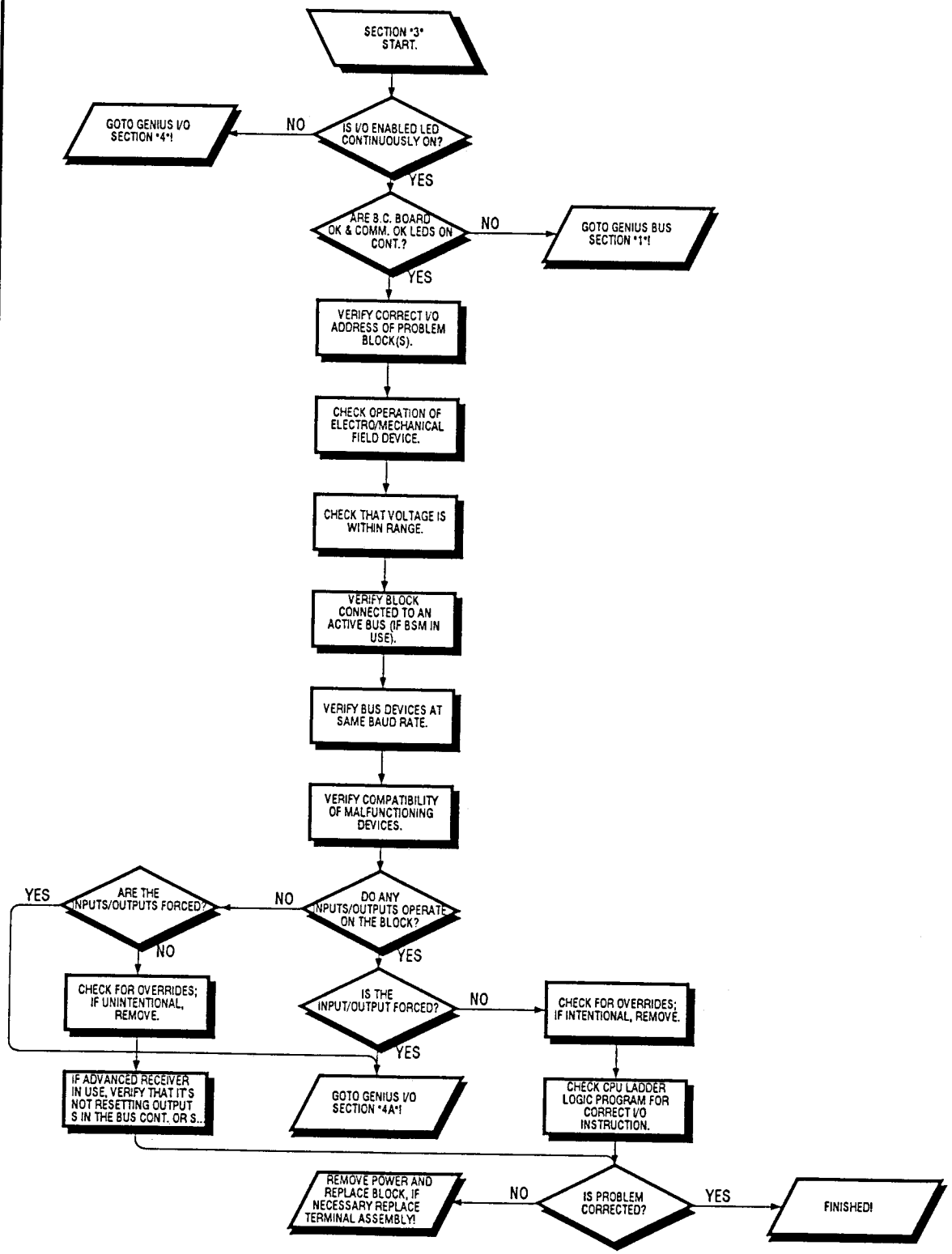
FILE TIGHTLINE DIA

FIGURE 4

CPU POWER SUPPLY TROUBLESHOOTING



GENIUS I/O TROUBLESHOOTING

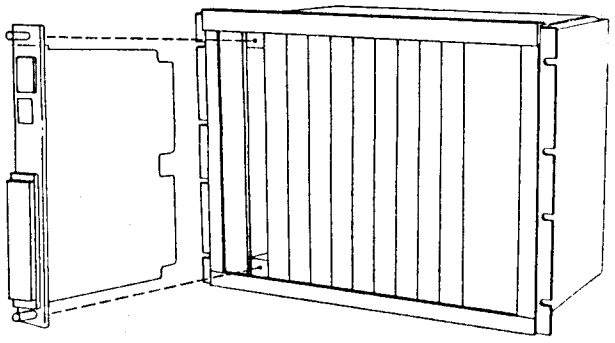


STEP 3. INSERT THE BUS CONTROLLER

After setting board options, install the Bus Controller in the rack by following these steps:

1. Position the Bus Controller to the left of the Reference Selection DIP switches you set. Using the board remover/installer, press the board carefully into the connector until it is securely lodged.

a41136



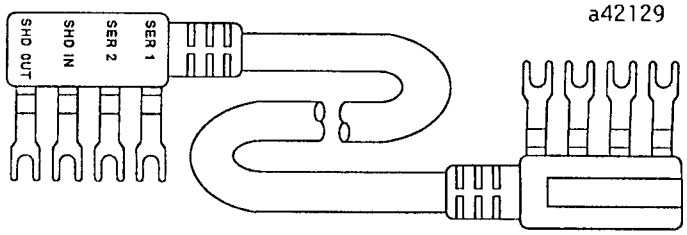
2. Position the faceplate over the Bus Controller and tighten the screws.

STEP 4. WIRE THE SERIAL BUS

Using shielded, twisted pair cable, create a serial bus connecting the Bus Controller, I/O blocks, and other permanently-installed devices.

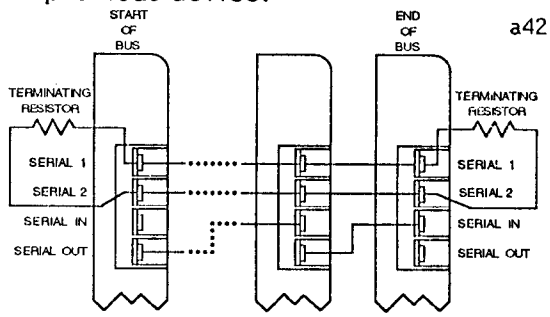
Cable used for one serial bus must all be the same, or the bus will not work. Other busses connected to the same CPU may use different types of cable (unless joined by a Bus Switching Module, as described on the next page). Cable specifications are listed below. For applications using Belden 9182 type cable, prefabricated cables are available in 15-inch and 3-foot lengths. See the Ordering Information on page 8.

a42129



Connect the Serial 1 terminals of adjacent devices together and the Serial 2 terminals of adjacent devices together. Connect each Shield In terminal to the Shield Out terminal of the previous device.

a42196



Cable # & Make	Outer Diameter	Terminating Resistor* -10%to+20% ½ Watt	Installation	Number of Conduc-tors/AWG	Di-Electric Voltage Rating	Ambient Temp Rating	Maximum Length Cable Run, feet/meters at baud rate			
							153.6s	153.6e	76.8	38.4
(B)9182 (A)9823 (C)4596	.350in 8.89mm	150 ohms	In conduit	2 / #22	30v	60°C	2000ft 606m	3500ft 1061m	4500ft 1364m	7500ft 2283m●
(B)89128	.322in 8.18mm	150 ohms	In plenum No conduit	2 / #22	150v	200°C	2000ft 606m	3500ft 1061m	4500ft 1364m	7500ft 2283m●
(B)9841	.270in 6.86mm	120 ohms*	Double Shields	2 / #24	30v	80°C	1000ft 303m	1500ft 455m	2500ft 758m	3500ft 1061m●
(B)9207	.330in 8.38mm	100 ohms	In Conduit	2 / #20	300v	80°C	1500ft 455m	2500ft 758m	3500ft 1061m	6000ft 1818m●
(B)89207 (A)4794	.282in 7.16mm	100 ohms	In plenum No conduit	2 / #20	150v	200°C	1500ft 455m	2500ft 758m	3500ft 1061m	6000ft 1818m●
(B)9815	.330in 8.38mm	100 ohms	Direct Burial	2 / #20			1500ft 455m	2500ft 758m	3500ft 1061m	6000ft 1818m●
(B)9855	.315in 8.00mm	100 ohms	In Conduit	4 (two pair) #22	150v	60°C	1200ft 364m	1700ft 516m	3000ft 909m	4500ft 1364m●
(B)89696 (B)89855	.274in 6.96m	100 ohms	In plenum No Conduit fire resist	4 (two pair) #22	150v	200°C	1200ft 364m	1700ft 516m	3000ft 909m	4500ft 1364m●
(B)9463 (A)9814	.243in 6.17mm	75 ohms	In Conduit	2 / #20	150v	60°C	800ft 242m	1500ft 455m	2500ft 758m	3500ft 1061m
(B)9302	.244in 6.20mm	75 ohms	In Conduit	4 (two pair) #22	300v	80°C	200ft 30m	500ft 152m	1200ft 333m	2500ft 758m

Notes: A = Alpha, B = Belden, C = Consolidated
● Limited to 16 taps at maximum length and 38.4 K baud.
* For the Bus Controller, use on-board jumper to select 150 ohms.

BLOCK SPECIFICATIONS

Block type:	8 circuit combination input and output
Standby power (all inputs and outputs off):	IC660BBD100: 12 Watts IC660BBD101: 8.5 Watts
LED's (I/O Block):	Unit OK, I/O Enabled
LED's (each circuit):	On logic side of switch
Block to Block Isolation:	1500 V
Terminal Wiring:	One AWG 12 or two AWG 14
Weight:	4 lbs. (1.8 kg)
Heat Dissipation:	14.8W minimum with 8 inputs. 43.5W maximum with 8 outputs on at 2 amps.
Operating voltage (single source):	93-132 VAC
Frequency:	47-63 Hz
Power supply dropout time:	1 cycle (16.7mS at 60Hz, 20mS at 50Hz)

Input Characteristics:

	IC660BBD100	IC660BBD101
Non-tristate input, OFF state:		
Minimum voltage across input device (IN to H)	60 VRMS	60 VRMS
Maximum leakage through input device	1 mA	1 mA
Non-tristate input, ON state:		
Maximum voltage across input device (IN to H)	20 VRMS	20 VRMS
Maximum switch current threshold	6 mA RMS	6 mA RMS
Tristate input, OFF state:		
Acceptable voltage across input device (IN to H)	16 VRMS-40 VRMS	16 VRMS-40 VRMS
Tristate input, ON state:		
Maximum voltage across input device (IN to H)	4 VRMS	4 VRMS
Input load network:		
Resistor to "N"	13K ohms	13K ohms
Capacitor to "H"	.22 mfd	.10 mfd
Input processing time (typical)	2 ms + filter	
Selectable input filter times	10 to 100 ms in 10 ms increments	
Input diagnostics	Open Wire, Overtemperature	

Output Characteristics:

	IC660BBD100	IC660BBD101
Circuit output current (steady state)	2 amps RMS	2 amps RMS
Maximum inrush current up to 2 cycles	30 amps peak	30 amps peak
Maximum inrush current 2-6 cycles	20 amps peak	20 amps peak
Maximum block output current	15 amps maximum per block at 35° C 7.5 amps maximum per block at 60° C	
Output Leakage @ 115 VAC:		
Current at 0 volt output (OUT to N)	<13mA	<7mA
Voltage at open output (OUT to N)	95 volts	65 volts
Output switch (OFF to ON/ON to OFF)	Zero crossing	Zero crossing
Maximum switching frequency	Once per second (high inrush currents)	
Turn-on delay (maximum)	0.5 Hz + 1 ms	0.5 Hz + 1 ms
Voltage drop (at 2 amps)	2.5 volts	2.5 volts
Voltage drop (at 30 amps inrush)	10 volts	10 volts
Recommended minimum load, resistive:	30mA	25mA
Recommended minimum load, inductive:	100mA	40mA
Fusing	Internal electronic short circuit trip. 100ms long time trip	
Output diagnostics	Short Circuit, Overload, No Load, Failed Switch, Overtemperature	

Environmental:

Operating Temperature	-0° to +60° C (32° to +140° F)
Storage Temperature	-40° to +100° C (-40° to +212° F)
Humidity	5% to 95% (non-condensing)
Vibration	5-10 Hz 0.2" displacement
10-200 Hz at 1G	

ORDERING INFORMATION

Description	Catalog Number	115 VAC Low-leakage I/O Block
115 VAC I/O Block	IC660BBD100	IC660BBD101
Terminal Assembly Only	IC660TSD100	IC660TSD100
Electronics Assembly Only	IC660EBD100	IC660EBD101

CONTENT OF THIS DATA SHEET

This data sheet describes installation and features of 115VAC/125VDC Isolated blocks.

Block Description	2
Compatibility	2
Bus Scan Times	2
Installation	3
Wiring	3
Block LEDs	5
Removing/Inserting the Electronics Assembly	5
Configuration	6
Block Specifications	8

COMPATIBILITY

This block can be used with any bus interface module or Hand-held Monitor. Hand-held Monitor version HHM501 is required to use all the features described in this data sheet.

Both versions of the Isolated block are backward compatible with previous Isolated blocks and may be used to replace them.

Both Isolated block versions have the same Terminal Assembly (IC660TSS100). Electronics Assembly (IC660EBS100) may be used to replace any version Electronics Assembly IC660ELS100.

BUS SCAN TIMES

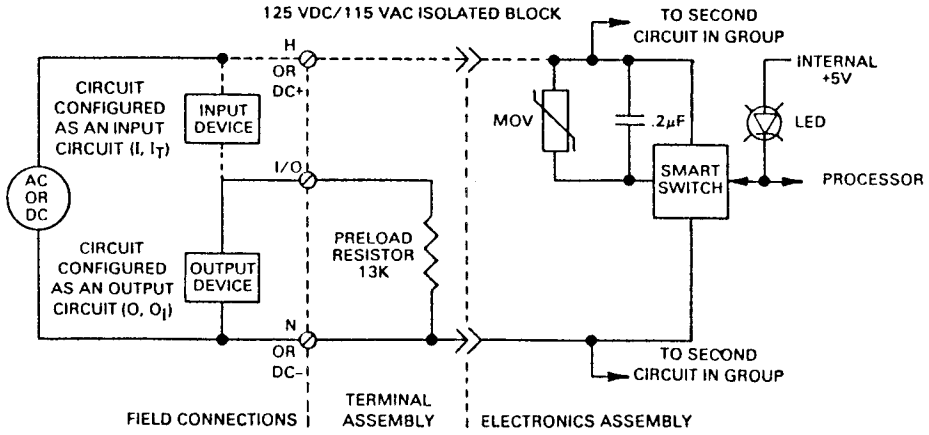
The scan time contribution for an Isolated I/O block depends on the baud rate, the block's I/O configuration, and the type and number of controllers on the bus. In the table below, use the appropriate A column if the interface module is a Series Six Bus Controller version IC660CBB900 or 901. For any other type of interface module, use the B column. If there is another bus interface module on the bus sending outputs to the block at the same time, use the C column. All times shown are in milliseconds.

BAUD RATE	INPUTS ONLY BLOCK Bus Controller Type			OUTPUTS/COMBINATION Bus Controller Type		
	A	B	C	A	B	C
153.6 Kb s	.30	.51	.73	.58	.58	.87
153.6 Kb e	n/a	.59	.81	n/a	.66	.95
76.8 Kb	n/a	1.18	1.61	n/a	1.32	1.89
38.4 Kb	n/a	2.37	3.13	n/a	2.65	3.79

BLOCK DESCRIPTION

A 115 VAC/125 VDC Isolated Input/Output Block provides eight circuits rated to operate at a nominal 115 volts AC or 125 volts DC.

a40653



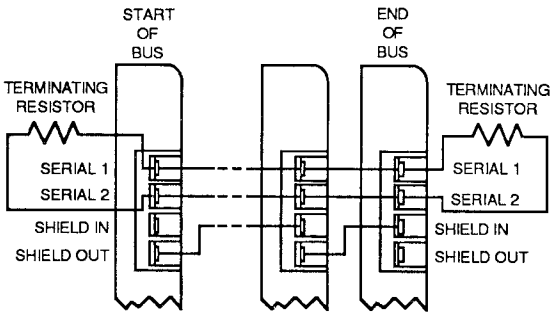
Note: The 13KL internal preload resistor remains connected when the Electronics Assembly is removed from the Terminal Assembly.

Serial Bus Wiring

a43020

Wire the serial bus by connecting the Serial 1 terminals of adjacent devices together and the Serial 2 terminals of adjacent devices together. Connect Shield In to the Shield Out terminal of the previous device.

a42196



For the last block (electrically) on the bus, connect a terminating plug across the Serial 1 and Serial 2 terminals.

Field Wiring

Any circuit can be an input or output. Connect one terminal of a field device to DC power and the other to the block (terminals 10-41). All I/O devices must return to the same power circuit.

For block power, connect a DC source to the DC+ terminals (5-9) and the return to the DC- terminals (42-46). Depending on layout and current loads, positive and negative connections can be bussed and made by single wires to the block or power source.

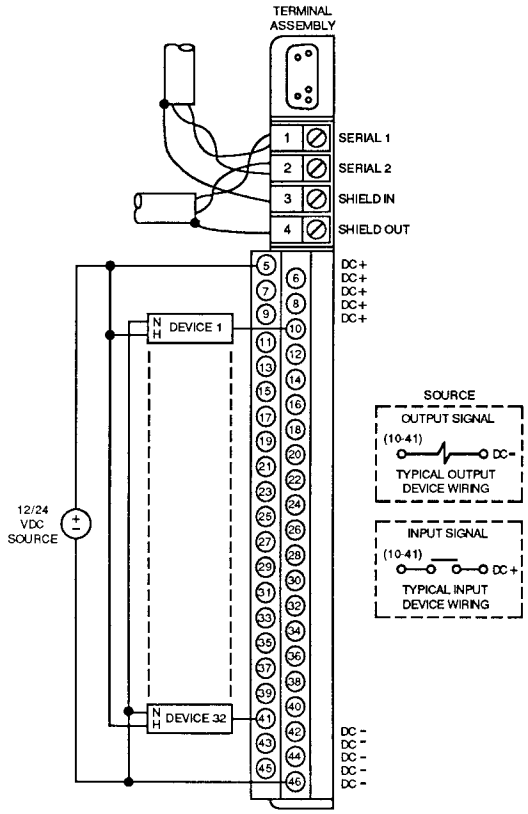
To disable the block without removing power from input devices, use a Block Puller to unplug the Electronics Assembly. Do not disconnect H or N to remove power.

For a Sink block, connect outputs to the positive side of the power supply and inputs to the negative side.

For 5 volt Sink applications *only*, jumper the +5V terminal to any DC+ terminal.

CAUTION

Do not jumper the +5V terminal to DC+ for 12 or 24 volt sink applications. Do not apply more than 5.25 volts to the +5V terminal. Damage to the block may result.



CONFIGURATION

Each block must be configured with the Hand-held Monitor to:

- Enter its Block Number (serial bus device number).
- Enter its Reference Number (required for Series Five and Series Six PLCs only).

Additional features, described below, can be changed by configuration from the Hand-held Monitor or the application program. Configuration for all blocks should be planned according to information supplied in the *Genius I/O System User's Manual*.

Configuration Protection: Prevents accidental or unauthorized changes to the block's configuration.

Current/Voltage Range: The voltage range of the circuit:

0-10 volts DC
-10 volts DC to +10 volts DC
-5 volts DC to +5 volts DC
0-5 volts DC
4-20 mA/1-5 volts DC.

The range selection is a setup parameter; it should NOT be changed while the block is operating.

Fault Reporting: Selects whether faults will be reported to the CPU for each circuit individually.

Input Filter Time: a filter time from 8 ms to 1024 ms can be independently selected for each input on the block. 4 ms unfiltered sampling is also available.

Filter time is a setup parameter; it should NOT be changed while the block is operating.

Alarm Input Mode: Selects whether an input will send its current value to the CPU, or only a normal/high alarm/low alarm indication.

Low/High Alarms: Scaled values between ±32,767 for each input, representing a low or high alarm. These limits may be used for either Normal-mode or Alarm-mode inputs (see above).

Scaling Points: Used to convert the raw analog signal to/from engineering units.

Hold Last State: Each output can be configured to maintain its last value if CPU communications are lost and Output Default Value is not selected.

Output Default Value: Each output can be configured to default to a preselected value at powerup, or if CPU communication is lost.

Redundancy Mode: Selects no redundancy or "Hot Standby" mode.

BSM Present: Selected if the block is wired to dual serial bus via a Bus Switching Module.

Outputs Timeout Select: If BSM Present has been selected, this feature selects either 2.5 or 10 seconds as the delay for output defaults.

Baud Rate: May be 153.6 Kbaud standard, 153.6 Kbaud extended, 76.8 Kbaud, or 38.4 Kbaud. *All devices on the bus must use the same baud rate.*

Default Configuration

The following table lists factory default settings for the block's configurable features.

RTD INPUT BLOCKS: SPECIFICATIONS

Block Type:	Six RTD-compatible inputs, three isolated groups of two	
LED's (I/O Block):	Unit OK, I/O Enabled	
Block to Block Isolation:	1500 V	
Group to Group Isolation:	300 V	
Terminal Wiring:	Terminals 1-4: one AWG # 12 or two AWG #14 Terminals 5-22: AWG #22 to AWG #14	
Weight:	4 lbs. (1.8 kg)	
Heat Dissipation:	7W maximum	
115VAC/125 VDC block power:	**115 VAC**	**125 VDC**
Power supply voltage:	93-132 VAC @ 7W 47-63 Hz	105-145 VDC @ 7W 10% max. ripple
Power supply dropout time:	1 cycle	10 mS
24/48 VDC block power:		
Power supply voltage:	18-56 VDC @ 7W, 10% max. ripple	
Power supply dropout time:	10 mS	
Input Characteristics:		
Input resolution	±0.1 degree C	
Absolute accuracy (at 25° C)		
Platinum or Nickel:	±0.5 degree C typical, ±1.0 degree C maximum	
10Ω Copper:	±5 degree C typical, ±10 degree C maximum	
Input update frequency	Once every 400 mS, 800 mS, or 1600 mS	
Input filter ranges (per block)	400 mS, 800 mS, 1600 mS	
RTD linearization	Platinum (DIN 43760), Nickel (DIN 43760), Copper, Linear	
Resistance range	0 to 5000Ω	
Diagnostics	Input shorted, Internal fault, Wiring error, Open Wire, Overrange, Underrange, High Alarm, Low Alarm	
Environmental:		
Operating Temperature	0°C to +60° C (32°F to +140°F)	
Storage Temperature	-40°C to +100° C (-40°F to +212°F)	
Humidity	5% to 95% (non-condensing)	

ORDERING INFORMATION

Description	Catalog Number
115 VAC/125 VDC RTD Input Block	IC660BBA101
Terminal Assembly Only	IC660TBA101
Electronics Assembly Only	IC660EBA101
24/48 VDC RTD Input Block	IC660BBA021
Terminal Assembly Only	IC660TBA021
Electronics Assembly Only	IC660EBA021

To Select the Host CPU. A new Hand-held Monitor is set up to operate with a Series Six PLC. Alternate selections are SERIES FIVE or SERIES 90/PCIM. To change the current selection, press the F2 (TGL) key, then press F3 (Enter).

Press F4 (Next). The screen shows whether automatic shutoff is selected:

```
AUTO OFF =10min
ENABLED
```

To Enable/Disable Automatic Shutoff: this feature conserves battery power by shutting off the Hand-held Monitor 10 minutes after the last key entry. To change the current selection, press F2 (Toggle), then F3 (Enter).

Press F4 (Next). The display shows whether the Hand-held Monitor can be used to configure the Block Number (serial bus address) of I/O blocks, as well as the I/O circuit mix of some types of blocks. For the Series Six and the Series Five PLC, this selection also determines whether the HHM can be used to assign the Reference Address of I/O blocks.

```
CHNG BLK ID
ENABLED
```

To Enable/Disable Changing Block ID Parameters, press F2 TGL, then press F3 (Enter).

Press F4 (Next). The configuration screen shows whether the HHM can be used to change the baud rate of I/O blocks:

```
CHNG BLK BAUD
ENABLED
```

To Enable/Disable Changing I/O Block Baud Rate, press F2 (TGL) then press F3 (Enter).

Press F4 (Next). The display shows whether the HHM can be used to configure the features of I/O blocks:

```
CHNG BLK. CONFIG
ENABLED
```

To Enable/Disable I/O Block Configuration, press F2 (Toggle),. then F3 (Enter).

Press F4 (Next). The display shows whether the HHM can be used to force I/O circuits:

```
CIRCUIT FORCING
ENABLED
```

To Enable/Disable I/O Circuit Forcing: press F2 (Toggle) then F3 (Enter).

Press F4 (Next). The display shows whether this HHM can clear faults:

```
CLEAR BLK FAULTS
ENABLED
```

To Enable/Disable Fault Clearing, press F2 (Toggle) then F3 (Enter).

Press F4 (Next). The display shows whether the HHM can display memory content from other devices:

```
EXAM DEV MEMORY
DISABLED
```

To Enable/Disable Reading Device Memory, press F2 (Toggle) then F3 (Enter).

PULSE TESTING OUTPUTS

Pulse Testing verifies the ability of outputs on a discrete block to change state. Pulse Testing also indicates whether output circuits (wires, power sources, loads) will start or stop current flow. Pulse testing is recommended for blocks controlling outputs that seldom change state. It provides assurance that when needed, an output will operate correctly. Blocks that control outputs which frequently change state do not need to use the Pulse Test feature. Pulse Testing does not provide enough energy to activate mechanical devices such as motor starters, relays, or solenoid valves, but may change the state of a very small load.

Executing a Pulse Test

The block being Pulse Tested must be the active block.

1. Press F2 from the Home menu to display the Analyze functions menu:

```
F1:MONITOR BLOCK
F2:MNTR/CTRL REF
F3:BLOCK/BUS STS
F4:PULSE TEST
```

2. Press F4 (Pulse Test) from the Analyze menu. The display shows:

```
PULSE TEST
REFS      33-  48  0
NO FAULTS
exec
```

   Line 2 shows the block's reference numbers and I/O configuration. Line 3 shows whether faults are associated with any I/O references.

3. Press F1 (Execute) to pulse all outputs on the block once. If the word **FAULTS** appears, it means that one or more diagnostic errors have occurred. Go to the Monitor/Control menu to display the specific type of fault that has occurred. It will be one of the following, *depending on the block type:*

```
FAILED SWITCH
SHORT CIRCUIT
NO LOAD
LOSS OF I/O POWER
```

   For more information, refer to the fault definitions on the previous page. The fault message must be cleared.

Clearing Faults on the Active Block

If you press the CLEAR key from the Pulse Test screen, *all faults on the block* will be cleared.

If you press the Clear key from the Monitor/Control screen (after displaying a specific circuit fault), only that fault will be cleared.

Pulse Test Error Messages

If the Pulse Test cannot be performed or if the block fails to respond, a error message appears. Press the Clear key to remove the message.

E:PUL TST DISABLE
A Pulse Test cannot be performed unless the block's configuration is changed.

E:INVLD BLK TYPE
The block does not support Pulse Tests.

E:INVLD BLK CONFIG
The active block is an inputs-only block.

E:PULSE TEST FAIL
The HHM has not received an acknowledgement from the block within the predetermined amount of time. Retry the test. If it continues to fail, check the serial bus cable and active block.

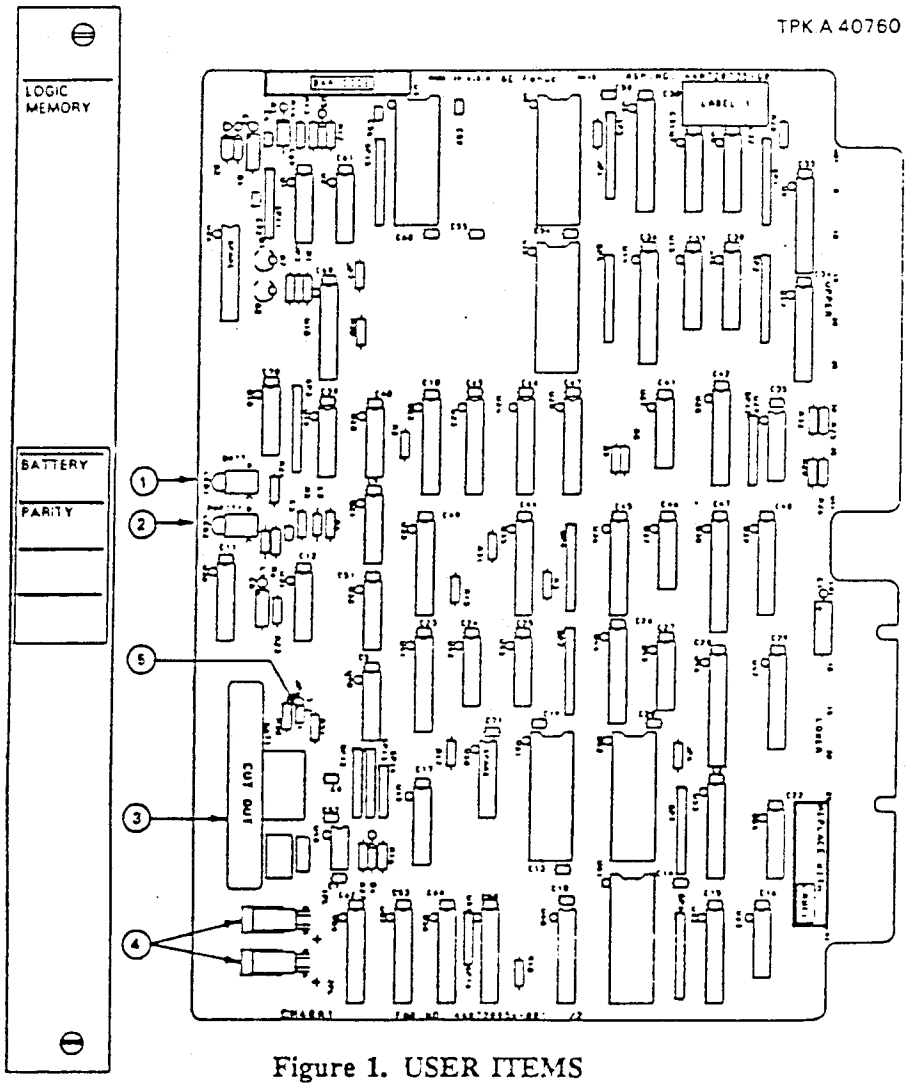


Figure 1. USER ITEMS

1. BATTERY Light

Steady On: Battery Normal

Flashing: Battery Low: The CPU continues running. No. 2 (advisory) alarm is activated. To protect the memory contents, replace the battery before it fails. When the light begins to flash, battery failure will occur in approximately 30 days.

Steady Off: Battery Failed: CPU continues running, but will not restart if stopped. No. 2 alarm remains activated. Memory contents will be lost when power is switched off or lost.

2. PARITY Light

On: Internal Memory, Register Memory and Logic Memory Parity are OK.

Off: Internal Memory and/or Register Memory or Logic Memory parity error occurred when reading memory. An error message appears on the Workmaster® Computer display or in the work area of the Program Development Terminal display. Causes CPU to stop.

3. Lithium-Manganese Dioxide Battery

4. Battery Connectors

5. External Auxiliary Battery Select

NOTE

For battery replacement information, consult the Series Six Plus Installation and Maintenance Manual, GEK-96602.

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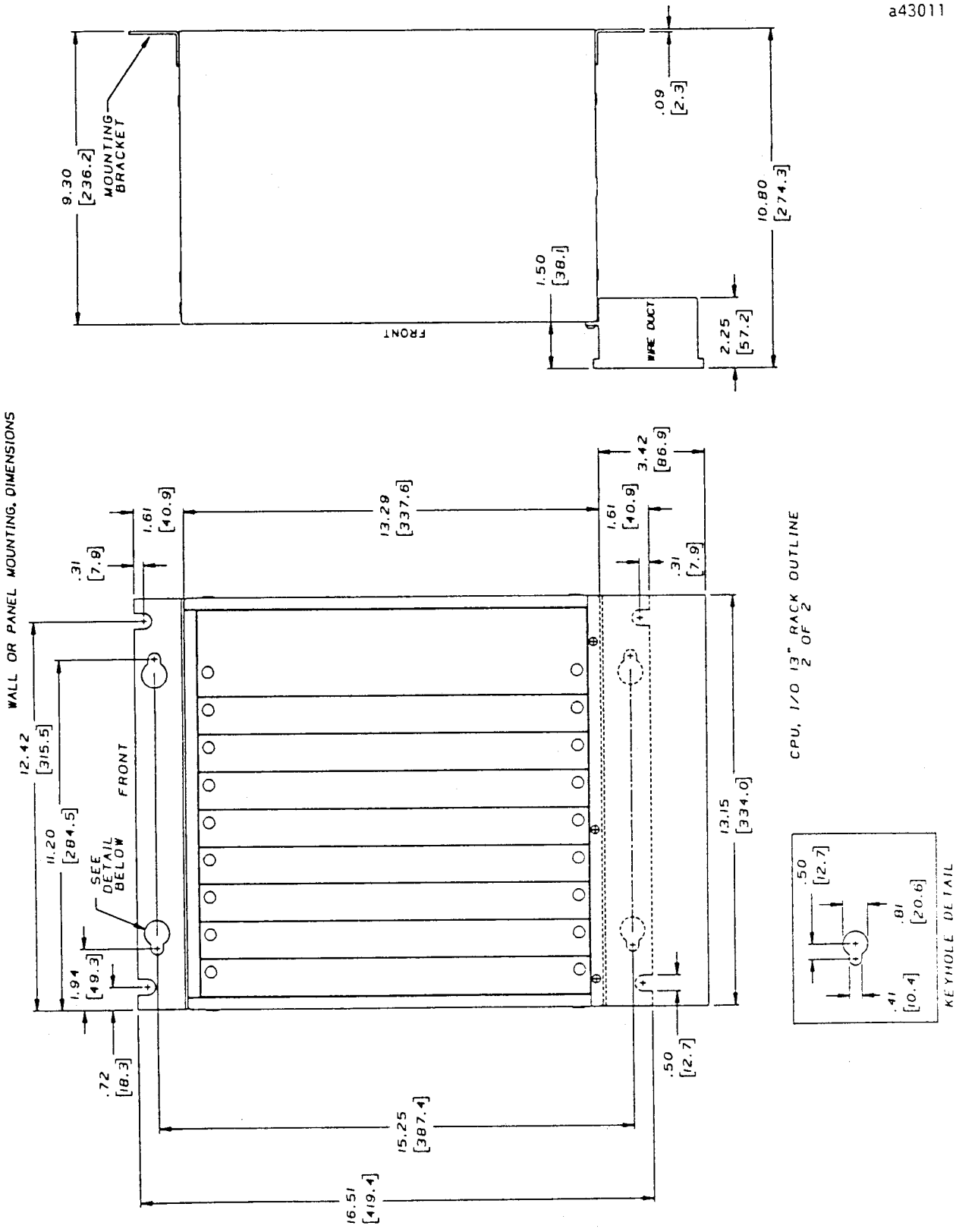
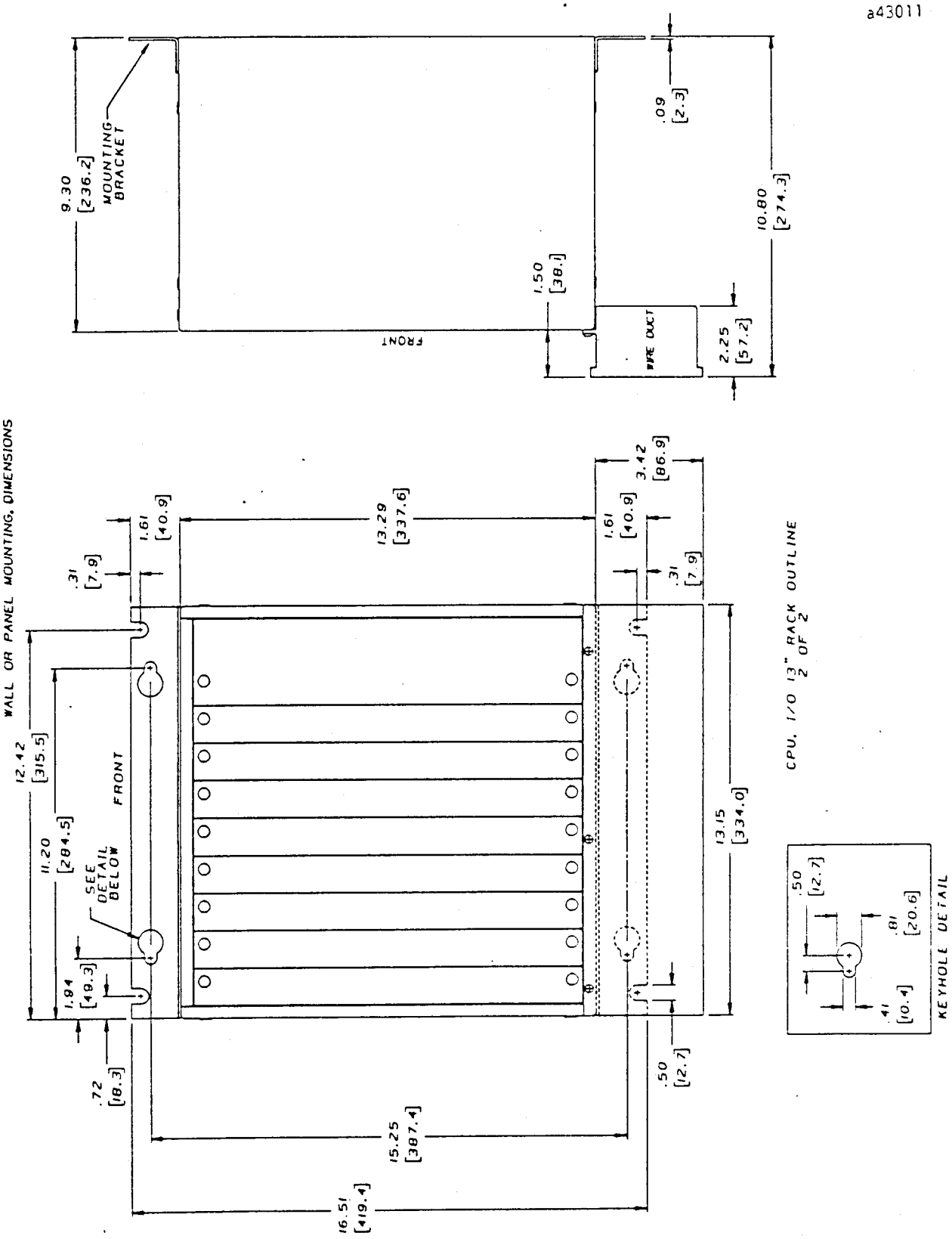

9.30 [236.2]
MOUNTING BRACKET
.09 [2.3]
10.80 [274.3]
1.50 [38.1]
FRONT
WIRE DUCT
2.25 [57.2]
WALL OR PANEL MOUNTING DIMENSIONS
12.42 [315.5]
11.20 [284.5]
SEE DETAIL BELOW
FRONT
1.94 [49.3]
.72 [18.3]
.31 [7.9]
1.61 [40.9]
13.29 [337.6]
1.61 [40.9]
3.42 [86.9]
.31 [7.9]
13.15 [334.0]
.50 [12.7]
15.25 [387.4]
16.51 [419.4]
CPU, I/O 13" RACK OUTLINE
2 OF 2
.50 [12.7]
.81 [20.6]
.41 [10.4]
KEYHOLE DETAIL


a43011
9.30 [236.2]
MOUNTING BRACKET
.09 [2.3]
10.80 [274.3]
1.50 [38.1]
FRONT
WIRE DUCT
2.25 [57.2]
WALL OR PANEL MOUNTING DIMENSIONS
12.42 [315.5]
11.20 [284.5]
SEE DETAIL BELOW
FRONT
1.84 [46.3]
.72 [18.3]
.31 [7.9]
1.61 [40.9]
13.29 [337.6]
1.61 [40.9]
3.42 [86.9]
.31 [7.9]
13.15 [334.0]
.50 [12.7]
15.25 [387.4]
16.51 [419.4]
CPU, I/O 13" RACK OUTLINE
2 OF 2
.50 [12.7]
.81 [20.6]
.41 [10.4]
KEYHOLE DETAIL

MODULE INSTALLATION

Prior to installing the CCM2 or CCM3 module into the Series Six Plus PLC rack, set the backplane DIP switch package to all positions OPEN for the module installation location. (slot 5 or 6)

PRODUCT ENHANCEMENTS

Several new features and enhancements are available to the user with this release. A brief description of the Series Six Communication Control Module (CCM2, CCM3) features and enhancements are as follows:

Expanded I/O Reference: A new method of addressing the I/O points within the Expanded Instruction Set has been devised to allow access of additional I/O points. This feature allows addressing of channelized I/O points available with the Series Six expanded instruction set. The I/O points can be accessed by both the CCM protocol and Remote Terminal Unit (RTU) protocol for CCM3, and the CCM protocol only for CCM2. CCM also supports addressing of the Auxiliary I/O Override table. Refer to the attached documentation, Table 1, which shows the I/O addressing for CCM and RTU protocols.

Expanded User Memory Reference: The expanded II instruction set allows memory addressing up to 64K of the user logic memory. The expanded user logic memory is supported by the CCM protocol.

Single Bit Write: The CCM2 and CCM3 offer a single bit write feature that may be used on the input, output, auxiliary input, auxiliary output and auxiliary override tables in the Series Six PLC. This feature has been added to the CCM protocol, and will permit the user to set, clear, or toggle a bit. Refer to Table 2, which lists the new memory types allocated for the single bit write feature.

Programmable Timeouts and Retrys: This feature allows timeout and retry value programming for the CCM protocol. Four SCREQs have been defined to allow timeouts and retrys to be programmed for both ports. Refer to Table 6, which shows the format of the new SCREQs allocated for this feature.

DOCUMENTATION

Addendum pages for GEK-25364 Series Six Data Communication Manual explain the enhancements for Communication Control Module (CCM2, CCM3).

Pages 1 and 2: Shows mapping between Series Six channeled I/O and CCM and RTU points. Contains examples to show how to map Series Six I/O points to CCM and RTU points.

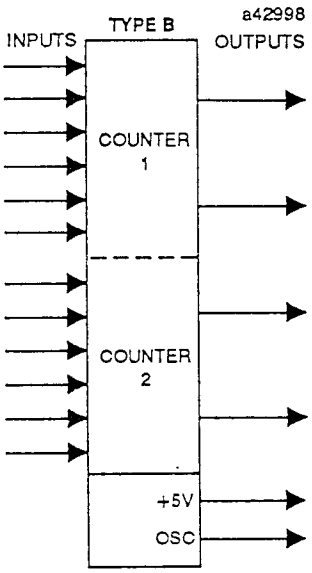
Pages 3 and 4: Lists the new memory types which define the target table and the bit write operation. Defines the bit write function invoked by the new SCREQ command in the ladder logic program. Shows the CCM protocol processing the bit write function.

Page 5: Lists the New SCREQs and default values for programmable retry and timeout values for the CCM protocol.

Affix the addendum documentation in your GEK-25364 manual for future reference.

Block Type B

If the block should operate as **two 24-bit counters**, "Type B" is selected during block configuration.



Each Type B counter has six inputs and two outputs, and may be separately configured for Up/Down, Pulse/Direction, or A Quad B operation.

Details of each Type B counter are shown at right. Each counter has two completely independent sets of Strobe inputs with storage registers and on/off Presets for each output. The Disable input, which is not available in the Type A configuration, can be used to inhibit counting.

The Disable input is level sensitive, and active high. All other inputs are edge-sensitive. Each Strobe input can be configured to be active on either the rising or the falling edge.

The Strobe inputs always use the 0.0025mS high-frequency filter. A high-frequency filter or a 12.5mS low-frequency filter can be independently selected for each of the following signals:

1. Preload input
2. "Disable" input
3. Both count inputs

The low-frequency filter reduces the effect of signal noise. Maximum count rates are 200 KHz with the high-frequency filter and 40 Hz with the low-frequency filter.

Elements of a Type B Counter (2 per block)