Micro Control Systems

APPLICATION NOTE
APP-012

Six Board Class Definitions

Revision History

Date	Author	Description
9/8/98	R Toney	App note created based upon App note 011

Theory

This app note documents all class structures for a six board system. App note 11 contains class structures for a four board system. These two app notes together with app note 7 provide complete documentation of the MCS network protocol for both the MCS-8 RS232 and RS485 communication ports.

Class Definitions

Index

General definitions:

Indexes:

- Fields that contain indexes to relay outputs, analog outputs, sensor inputs or set points contain relative pointers (0 points to the first entry) into the associated

class array or 255 if that field is not used. A valid index, not 255, must be less than the maximum number of entries for that array. These are hexadecimal numbers.

- Examples:
  - An index into either the relay output or sensor input arrays will be a number from 0 to 31 decimal or 0 to 1F hexadecimal.
  - An index into the set point array will be a number from 0 to 59 decimal or 0 to 3B hexadecimal.

Character:

- Fields defined as a character, CHAR, contain ASCII formatted characters.
  - Examples:
    - The Manufacturer's name that is in location 17-32 of the VERSION NUMBER EEPROM class will be stored as an array of characters that are terminated by a NULL (00) character:

(1st line = location, 2nd = ASCII characters and the 3rd = hexadecimal value)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
M	I	C	R	O		C	O	N	T	R	O	L			
4D	49	43	52	4F	20	43	4F	4E	54	52	4F	4C	20	20	00

Byte:

- Fields defined as a byte, BYTE, contain a value from 0 to 255 decimal or 0 to FF hexadecimal. These are only positive numbers and there are no decimal places.
  - Examples:
    - 9 will be stored as a 9
    - 16 will be stored as a 10
    - 254 will be stored as a FE

Integer:

- Fields defined as an integer, INT contains a decimal number in the range of negative 32767 to positive 32767. This defines a signed integer that is a whole number, all decimal places are assumed. This type of definition requires two positions. The number is stored with low value in the first position and its high value in the second position.

Decimal Value	# of decimal places	As printed	As stored	Hexa-decimal	Stored as
10	0	10	10	10	10 00
10	1	10	100	64	64 00
489	1	48.9	489	1E9	E9 01
201	2	201	20100	4E84	84 4e
-1568	0	-1568	-1568	F9E0	E0 F9
-32767	0	-32767	-32767	FFFF	FF FF

Long:

- Fields defined as long, Long, contain a decimal number in the range of negative 2,147,483,648 to positive 2,147,483,647. This defines an integer that is a signed whole number, all decimal places are assumed. This type of definition requires four positions. The number is stored with low value in the first position and its high value in the second position.

Decimal Value	Hexadecimal	Stored as

Unsigned long:

- Fields defined as unsigned long, Ulong contain a decimal number in the range of 0 to positive 4,294,967,295. This defines an integer that is a positive whole number, all decimal places are assumed. This type of definition requires four positions. The number is stored with low value in the first position and its high value in the fourth position.

Decimal Value	Hexadecimal	Stored as

Unsigned integer:

- Fields defined as unsigned integer, Word, a decimal number in the range of 0 to positive 65535. This defines an integer that is a positive whole number, all decimal places are assumed. This type of definition requires two positions. The number is stored with low value in the first position and its high value in the second position.

Decimal Value	Hexadecimal	Stored as
10	10	10 00
489	1E9	E9 01
32767	7FF	FF 07
65534	FFFE	FE FF

Time:

- Fields defined as HHMMSS contain a time value. These fields define the time as: hour, minute, second. This definition requires 3 positions, 1 for each item.
  - Examples:
    - The time 10:39:58 AM will be stored as hexadecimal 0A 27 38 in the 3 positions.
    - The time 2:15:28 PM will be stored as hexadecimal 0E 0F 1C in the 3 positions. Remember, time is stored as military time; therefore, the 2 PM become 14 which is a E in hexadecimal.

Arrays that are not classes:

The following four arrays must be built:

- Sensor name & characteristic array. This array will contain the sensor name, e.g. MCS-T100; character to be displayed, e.g. F; and number of assumed decimal places, e.g. 1. Indexes in the Sensor and Set Point classes will point to this array. Refer to SI EEPROM Class #5 for a definition of this array.

- System alarm names. This array will contain the alarm name. Refer to Alarm History Class #33 for a definition of this array.

- Capacity control state names. This array will contain the alarm name. Refer to Chiller Ram Class #23 for a definition of this array.

- Circuit control state names. This array will contain the alarm name. Refer to Chiller Ram Class #23 for a definition of this array.

Class #0 BEGIN EEPROM

Record size: 16
Number of records in the class: 1
Total array size: 16

This class contains the visual identification of the beginning of the EEROM area, the configuration data. This class contains fixed data, that is it is not changed in the PC-Config program or in a live unit.

Field definitions

Location	Type	Description
1-15	Char	**"*BEGINNING CFG*"**
16	Byte	Filler of 00

Class #1 VERSION NUMBER EEPROM

Record size: 80
Number of records in the class: 1
Total array size: 80

This class contains base information about the unit such as manufacturer, model number, date installed as well as the name of this configuration file. This information is displayed under the UNIT INFORMATION option of the SERVICE DIAGNOSTICS menu. Fields are build by the PC-Config program.

Field definitions

Location	Type	Description
1-16	Char	Unit's identification, displayed in Unit Information. This is an alpha-numeric field of a maximum of 15 characters plus a null character.
17-32	Char	Company name, displayed in Unit Information & in SYSTEM I.D. screens. This is an alpha-numeric field of a maximum of 15 characters plus a null character.
33-48	Char	Model identification, displayed in Unit Information & in SYSTEM I.D. screens. This is an alpha-numeric field of a maximum of 15 characters plus a null character.
49-51	MMD DYY	Date of system installation, displayed in Unit Information & in SYSTEM I.D. screens.
52-67	Char	Units serial number. This is an alpha-numeric field of a maximum of 15 characters plus a null character.

68	Byte	Version number of the configuration file that is being worked on. A 4 indicates a 4 board or a 6 board system. This field will always be a 6.
69	Byte	This field indicates the type of configuration file that is being worked on. Presently there are only two types of configuration files that are supported in the 6 board system. • 2 = Heatcraft, • 110 = Pump Control. Base on this field, the PC-CONFIG program will display a different screen for the base information screen.
70	Byte	PC-CONFIG will automatically place current month in this field. Value is stored as a hexadecimal number
71	Byte	PC-CONFIG will automatically place current day of month in this field. Value is stored as a hexadecimal number
72	Byte	PC-CONFIG will automatically place current year in this field. Value is stored as a hexadecimal number
73	Byte	PC-CONFIG will automatically place current hour in this field. Value is stored as a hexadecimal number
74	Byte	PC-CONFIG will automatically place current minute in this field. Value is stored as a hexadecimal number
75	Byte	PC-CONFIG will automatically place current month in this field. Value is stored as a hexadecimal number
76	Byte	PC-CONFIG will automatically place current day of month in this field. Value is stored as a hexadecimal number
77	Byte	PC-CONFIG will automatically place current year in this field. Value is stored as a hexadecimal number
78	Byte	PC-CONFIG will automatically place current hour in this field. Value is stored as a hexadecimal number
79	Byte	PC-CONFIG will automatically place current minute in this field. Value is stored as a hexadecimal number
80	Byte	Some of the applications support a model number, this will be stored in this field as a hexadecimal value.

Class #2 CHILLER EEPROM

Record size: 320
Number of records in the class: 1
Total array size: 320

This class contains information that ties the RO'S and SI'S to various functions. E.G. flow switch location. The options are contained in this class. The format and contain of this class vary depending on the type of configuration file, see location 69 of Class #1, VERSION NUMBER EEPROM.

Field definitions for Heatcraft configuration file:

Location	Type	Description
		Locations 1-32 apply to base information about the system.
1	Byte	Type of refrigeration that is being use. This field is not used at this time.
2	Byte	Type of compressor(s) that are on the system. • 1 = Reciprocating • 2 = Reciprocating with out oil control • 3 = Screw • 4 = Scroll • 5 = Hitachi screw • 6 = Bitzer screw • 7 = Variable speed
3	Byte	Type of condenser that is on the system. • 0 = No condenser • 1 = Common air • 2 = Individual air per circuit • 3 = Combined air, circuits 1 & 3 share the same condenser while circuits 2 & 4 share the same condenser. • 4 = Common water • 5 = Individual water
4	Byte	Type of evaporator that is on the system. This field is not used at this time.
5	Byte	The number of refrigeration cycles. Number can be from1 to 6.
6	Byte	Phase loss, Index point to sensor input that indicates phase loss for the entire system. If not used, then it is 255.
7	Byte	Ambient temperature, Index point to sensor input that is reading the ambient temperature. If not used, then it is 255.
8	Byte	Leaving liquid temperature, Index point to sensor input that is reading the leaving liquid temperature. If not used, then it is 255.
9	Byte	Entering liquid temperature, Index point to sensor input that is reading the entering liquid temperature. If not used, then it is 255.
10	Byte	Condenser flow switch, Index point to sensor input that provides a digit input when there is flow. If not used, then it is 255.
11	Byte	Water flow switch, Index point to sensor input that provides digit input when there is flow swtich. If not used, then it is 255.

12	Byte	True: Perform pump down when the compressor is started. False: DONOT perform pump down when the compressor is started.
13	Byte	True: If an I/O board is lost, then lock out the system. False: If an I/O board is lost, do not lock out the system, keep the system running. An alarm will always be generated.
14	Byte	Option that specifies whether the control is on returning liquid, field will be a 1, else control will be on leaving liquid.
15	Byte	Field is not used at this time. Filler of 255.
16	Byte	Option anti cycle timer. If true, the system will start the anti cycle timer when the compressor is turned on. Else anti cycle timer when the compressor is turned off.
17	Byte	Field is not used at this time.
18	Byte	Field is not used at this time.
19	Byte	Emergency Stop indicator, Index point to sensor input that provides a digit input when the system is to stop running immediately. If not used, then it is 255.
20	Byte	Count of the total number of steps in the system. This can be a number from 1, single compressor single circuit, to 16, 4 circuits with a compressor and 3 unloaders or 2 unloaders and hot gas bypass on each circuit.
21	Byte	Count of the total number of condenser steps if a common condenser has been specified. If not used, then field is 0.
22	Byte	First relay output of condenser points for a common condenser, Index point to relay output. Note condenser points must be consecutive. If not used, then it is 255.
23	Byte	Run Stop indicator, Index point to sensor input that provides a digit input when the system is allowed to run. If not used, then it is 255.
24	Byte	Alarm relay output, Index point to relay output. This point will be turn on when an alarm is generated. If not used, then it is 255.
25	Byte	Sensor input for current limit option.
26	Byte	Sensor input for kw limit option.
27	Byte	Relay output that is turned on when a low ambient shut down exists.
28	Byte	Field is not used at this time.
29	Byte	Option for continuous pump down. If true, continuous pump down will be active. That is when the compressor is off the suction pressure will be checked. If high, the compressor will be turned on to reduce the suction pressure. If false, then the suction pressure will not be check when the compressor is off.

30	Byte	Temperature target reset, Index point to sensor input that will provide an adjustment to the temperature target. If not used, then it is 255.
31	Byte	Option for lead/lag control. If true, the system will automatically change the lead circuit. If false, then circuit 1 will always be the lead.
32	Byte	Sensor input that provides voltage.
33-80		**THESE FIELDS APPLY TO CIRCUIT #1 (THEY WILL BE REPEATED FOR CIRCUITS 2, 3, 4, 5 & 6)**
33	Byte	• 0 =
34	Byte	Number of compressor stages. Compressor, unloaders, hot gas bypass and liquid line solenoid are included in this count.
35	Byte	First compressor relay output point, Index point to relay output. Compressor points for this circuit must be consecutive. If not used, then it is 255.
36	Byte	Number of condenser stages associated with this circuit, not common condenser.
37	Byte	First condenser relay output point, Index point to relay output. Condenser points for this circuit must be consecutive. If not used, then it is 255.
38	Byte	Field is not used at this time. Filler of 255.
39	Byte	Field is not used at this time. Filler of 255.
40	Byte	Suction pressure, Index point to sensor input that will provide: • if a pressure transducer, suction pressure or • if a digital input, an on condition when a low suction pressure condition is encountered. If not used, then it is 255.
41	Byte	Discharge pressure, Index point to sensor input that will provide: • if a pressure transducer, discharge pressure or • if a digital input, an on condition when a high discharge pressure condition is encountered. If not used, then it is 255.
42	Byte	Suction temperature, Index point to sensor input that will provide suction temperature. If not used, then it is 255.
43	Byte	Discharge temperature, Index point to sensor input that will provide discharge temperature. If not used, then it is 255.
44	Byte	Oil pressure, Index point to sensor input that will provide: • if a pressure transducer, oil pressure or • if a digital input, an on condition when a low oil pressure condition is encountered. If not used, then it is 255.
45	Byte	Oil temperature, Index point to sensor input that will provide oil temperature. If not used, then it is 255.

46	Byte	Compressor Amps, Index point to sensor input that will provide: • if a amp sensor, compressor amp draw or • if a digital input, an on condition when a high compressor amp draw condition is encountered. If not used, then it is 255.
47	Byte	Motor fault, Index point to sensor input that will provide a digital input. When on some type of compressor fault has occurred. If not used, then it is 255.
48	Byte	Field is not used at this time. Filler of 255.
49	Byte	Field is not used at this time. Filler of 255.
50	Byte	Field is not used at this time. Filler of 255.
51	Byte	Field is not used at this time. Filler of 255.
52	Byte	Field is not used at this time. Filler of 255.
53	Byte	Field is not used at this time. Filler of 255.
54	Byte	Field is not used at this time. Filler of 255.
55	Byte	Field is not used at this time. Filler of 255.
56	Byte	Field is not used at this time. Filler of 255.
57	Byte	Field is not used at this time. Filler of 255.
58	Byte	Field is not used at this time. Filler of 255.
59	Byte	Type of valve for the evaporator: 0 = Liquid Line Soleniod 1 = Pulsed expansion valve 2 = 4-20 ma expansion valve 255 = none
60	Byte	Option for hot gas bypass. If true, a hot gas bypass exists for this circuit. An RO index pointer is not required as compressor points must be in a fixed sequence.
61	Byte	Number 1 to 4, indicates the number of compressors that are on this circuit.
62	Byte	Number 0,1 or 2, indicates the number of unloaders that are on each compressor.
63	Byte	Motor Oil Pressure, Index point to sensor input that will provide motor oil pressure. If not used, then it is 255.
64	Byte	Phase Loss, Index point to digital input that when on indicates a phase loss condition. If not used, then it is 255.
65	Byte	Pump down, Index point to sensor input that indicates the circuit must be pumped and moved to an off state if it is already on or if off remain off. If not used, then it is 255.
66	Byte	Water flow switch for this circuit only, Index point to sensor input that provides a digit input when there is flow. If not used, then it is 255.
67	Byte	Option for part winding starter. If true, two RO are required to start the compressor, this must be included in the point count of number of compressor stages.

68	Byte	Compressor proof indicator, Index point to sensor input that provides a digit input when the associated compressor is on. If not used, then it is 255.
69	Byte	If True, then control a oil flow solenoid.
70	Byte	If True, then control a liquid injection solenoid.
71	Byte	Relay output that is turned on when this circuit is in a anti-cycle state.
72	Byte	Condenser Water flow switch for this circuit only, Index point to sensor input that provides a digit input when there is flow. If not used, then it is 255.
73	Byte	Leaving liquid temperature for this circuit only, Index point to sensor input that provides a the temperature of the leaving liquid for this circuit. If not used, then it is 255.
74	Byte	Pointer to the expansion valve. This can be either a RO or AO depending on the type of valve.
75-80	Bytes	This is for filler only.
81-128		**THESE FIELDS APPLY TO CIRCUIT #2 (They are the same fields as defined above)**
129-176		**THESE FIELDS APPLY TO CIRCUIT #3 (They are the same fields as defined above)**
177-224		**THESE FIELDS APPLY TO CIRCUIT #4 (They are the same fields as defined above)**
225-272		**THESE FIELDS APPLY TO CIRCUIT #5 (They are the same fields as defined above)**
272-320		**THESE FIELDS APPLY TO CIRCUIT #6 (They are the same fields as defined above)**

Class #3 RO EEPROM

Record size: 32
Number of records in the class: 48
Total array size: 1536

This class contains describes the individual relay outputs and their characteristics. Fields are build by the PC-Config program.

Field definitions

Location	Type	Description
1-8	byte	Up to an 8 character alpha-numeric name.
8-16	byte	Filler, null characters, 00 hexadecimal.
17	byte	Indicate if relay is inverted, field is a 1, or a 0 if relay is not inverted.

18	byte	Display text
19	byte	Field is not used.
20	byte	Key pad type.
21	byte	This field is used for pulsed output. If non-pulsed that is on or off output the field is 0. For pulsed output such as electronic expansion valves, each count is equal to 1/10 of a second duration when the relay is on.
22-32	byte	Filler, not used.

Class #4 AO EEPROM

Record size: 32
Number of records in the class: 12
Total array size: 384

This class contains describes the individual analog output names. Fields are build by the PC-Config program.

Field definitions

Location	Type	Description
1-8	Byte	Up to an 8 character alpha-numeric name.
9-32	Byte	Filler, this are is not used.

Class #5 SI EEPROM

Record size: 32
Number of records in the class: 48
Total array size: 1536

This class contains describes the individual sensor inputs and their characteristics. Fields are build by the PC-Config program.

Field definitions

Location	Type	Description
1-8	Char	Up to an 8 character alpha-numeric name.
9-16	Char	Filler, 00 hexadecimal characters.
17	Byte	Index in to Sensor name & characteristic array to select the type of sensor. See below for definition of this array.

18	Byte	Indicates the state of this sensor input. If field is equal to • 0 = auto, the analog input count will be converted based upon the type of input. • 1 = manual, if analog, the manual value will be displayed. • 1 = manual on, if digital. • 2 = manual off, if digital.
19-20	INT	If a digital (DI) then this field is as follows: • 19 byte 0 = non inverted, 1 = inverted. • 10 byte is not used. If an analog, then this field contains the manual value, that is the value that is used when this input is in manual.
21-22	INT	If a digital (DI) then this field is Not Used. If an analog, then this an offset is applied to the sensor reading. This field is used to calibrate
23	Byte	This field is not used.
24	Byte	If a digital (DI) then this field indicates how its status (ON/OFF) will be displayed. Else this field is not used.
25	Byte	This is an index that points to a set point. This is required for a sensor that requires a set point to complete the conversion. An example of this is the CFM sensors. The fan area is contained in the associated set point.
26-32	Byte	Filler, not used.

Sensor name & characteristic array

This is a multi dimensional array: the sensor name 1 to 7 ASCII characters followed by a NULL character (00), the character to be printed (both English and Metric) and the number of assumed decimal places are contained in this array. The reference number column is shown only for reference.

Reference number	Sensor Name	English char	Metric char	Number of decimal places
0	SPARE			0
1	MCSX400	P	B	1
2	MCST100	F	C	1
3	AMPS100	A	A	1
4	HOUR	H	H	0
5	STATIC3	“	“	1
6	HUMD	%	%	1
7	CT-100	A	A	1
8	RPM’S	R	R	0
9	STATIC5	“	“	1
10	DAYS	D	D	0
11	SECONDS	s	s	0
12	DIGITAL			0

13	CT-250	A	A	1
14	AKS31R5	P	B	1
15	THERMST			0
16	CYCLES	c	c	0
17	PERCENT	%	%	1
18	SWITCH			0
19	HMW40U	%	%	1
20	AMPS250	A	A	1
21	VOLT5DC	V	V	1
22	MEDIA-5	P	B	1
23	TRGTRST	F	C	1
24	TI-500	P	B	1
25	MCSX500	P	B	1
26	MINUTES	m	M	0
27	METER P	p	p	0
28	VEL 3in	c	c	0
29	VEL 5in	c	c	0
30	Not Used			0
31	Not Used			0
32	ECLIP-5	P	B	1
33	STAT1 F	F	C	1
34	STAT1 %	%	%	1
35	STAT1SY			0
36	STAT1FN			0
37	STAT2 F	F	C	1
38	STAT2 %	%	%	1
39	STAT2SY			0
40	STAT2FN			0
41	STAT3 F	F	C	1
42	STAT3 %	%	%	1
43	STAT3SY			0
44	STAT3FN			0
45	A110x2	A	A	1
46	A250x2	A	A	1
47	MAX %	%	%	1
48	STAT.25	“	“	2
49	STATIC1	“	“	1
50	CFM .25	c	c	0
51	CFM 1	c	c	0
52	VOLT230	V	V	1
53	AKS32-2	P	B	1
54	AKS32-5	P	B	1
55	VOLT460	V	V	1
56	ENTHLPY	h	h	1
57	MTRTEMP			0
58	TI-2ACE	A	A	1
59	DIFF100	P	B	1

Class #6 SETPOINT EEPROM

Record size: 32
Number of records in the class: 120
Total array size: 3840

This class contains information relating to set points.

Field definitions

Location	Type	Description
1-12	Char	Up to 12 character alpha-numeric name. Unused characters will be filled with null characters, 00 hexadecimal.
13-15	Char	Filler of null characters, 00 hexadecimal.
16	Char	The time to remain in the safety tripped state.
17	Byte	Field indicates type of set point: • 1, target. • 3, safety, when it trips, the circuit or the entire system will enter a safety state. The system will attempt to automatically restart the system. If the safety occurs again with the specified time limit, the circuit or the entire system will be shut down. This may be a lock out condition that requires manual intervention depending on the set point.
18	Byte	Flag indicates whether the set point is active or not: • 0 = active. • 255 = inactive.
19-20	INT	Numeric value assigned to this set point. The display type determines the number of decimal places. If there is a decimal place, it must be entered. E.g., 65.8 must be entered as ‘65.8’ not as ‘658’ in the PC-Config program. Value will be stored in hexadecimal as ‘292’.
21-22	INT	Same characteristics as the Value field. This is the minimum value that the set point value can be changed to. This value can not be view in a live MCS-8 and it can only be changed in the PC-Config program.
23-24	INT	Same characteristics as the Value field. This is the maximum value that the set point value can be changed to. This value can not be view in a live MCS-8 and it can only be changed in the PC-Config program.
25-28	Ulong	This is the safety time in seconds. The value being tested must be greater or less than depending on the set point for this period of time before the safety will trip.

29	Byte	Index into array that contains the character that identifies the value that is being displayed. E.g. P for pressure, s for seconds, F for temperature in Fahrenheit.
30	Byte	Minimum AUTH level to display this set point.
31	Byte	This is the value that this set point will incremented or decrement by when the value of this set point is being changed.
32	Byte	Time expressed in minutes, minimum time between safety trips to cause a lock out

Class #7 MACHINE EEPROM

Record size: 64
Number of records in the class: 1
Total array size: 64

This class contains information relating to the hardware configuration of the system. The number of points, boards, etc. This class is built by the PC-Config program and never changed.

Field definitions

Location	Type	Description
1	Byte	Number of relay output points, value from 0 to 48.
2	Byte	Number of analog output points, value from 0 to 12.
3	Byte	Number of sensor input points, value from 0 to 48.
4	Byte	Number of MCS-IO boards, value from 0 to 5.
		THE FOLLOWING FIELDS CONTAIN INFORMATION FOR MCS-8 BOARD, THIS WILL BE REPEATED FOR MCS-IO BOARDS #1, 2, 3, 4 & 5.
5	Byte	Not used at this time, constant 01.
6	Byte	Address of board, value of 0 for MCS-8, 1 for MCS-IO #1, 2 for MCS-IO #2 or 3 for MCS-IO #3.
7	Byte	Number of relay output points on this board, value from 0 to 8.
8	Byte	Number of analog output points on this board, value from 0 or 1.
9	Byte	Number of sensor input points on this board, value from 0 to 8.
10-11	Byte	Filler, not used.
12-18		**THE FOLLOWING FIELDS CONTAIN INFORMATION FOR MCS-IO BOARD #1.**
19-25		**THE FOLLOWING FIELDS CONTAIN INFORMATION FOR MCS-IO BOARD #2.**

26-32		**THE FOLLOWING FIELDS CONTAIN INFORMATION FOR MCS-IO BOARD #3.**
33-39		**THE FOLLOWING FIELDS CONTAIN INFORMATION FOR MCS-IO BOARD #4.**
40-46		**THE FOLLOWING FIELDS CONTAIN INFORMATION FOR MCS-IO BOARD #5.**
47	Byte	Not used at this time, constant 00.
48	Byte	Not used at this time, constant 00.
49	Byte	Not used at this time, constant 01.
50	Byte	Option: • 0, Fahrenheit & English PSI notation • 1, Centigrade & Metric bar PSI notation
51	Byte	Default key pad function, number from 1 to 8. Used for the key pad default display.
52	Byte	Default key pad point, number from 1 to 48. Used for the key pad default display.
53	Byte	Indicates type of type pad, will be constant of 10 decimal.
54	Byte	Number of communicating thermostats. If none could be 0 or 255.
55-64	Byte	Filler, not used.

Class #8 RESERVED

This class is reserved but not used at this time.

Class #9 AUTH EEPROM

Record size: 16
Number of records in the class: 15
Total array size: 240

This class contains all active authorization codes and their associated level of authorization. The authorization codes are established with PC-Config and can only be seen in this program.

Field definitions

Location	Type	Description
1-4	Byte	Four character alpha-numeric field. If the authorization is to be used from the MCS-8 keypad, then only numeric numbers one through eight can be used.

5-8	Byte	This field is not used.
9	Byte	Select level from the level pick list. Multiple codes can be assigned to the same level. • 0 = view only. • 1 = service level. • 2 = supervisor level. • 3 = factory level. Level 3, factory, is the highest level of authorization.
10-16	byte	Filler, this field is not used.

Class #10 HISTORY EEPROM

Record size: 16
Number of records in the class: 1
Total array size: 16

This class contains the sample time, how often history samples will be stored. This is built by the PC-Config program and may be modified by the PC-Conn program.

Field definitions

Location	Type	Description
1-2	Word	The sample time stored in seconds.
3-16	Byte	Filler, not used.

Class #11 RTC EEPROM

Record size: 16
Number of records in the class: 1
Total array size: 16

This class contains an indicator to determine if DLST is active and the months and time when the clock will be reset if active.

Field definitions

Location	Type	Description
1	Byte	Indicator whether day light savings time (DLST) is active: • 01 = yes, automatically change clock. • 00 = no, no change required.
2	Byte	Day of the week when DLST is to be checked. 01 for Sunday.
3	Byte	Hour of the day when DLST is to be checked. 02 for 2AM.

4	Byte	Month when clock is to be moved forward one hour. 04 for April.
5	Byte	The first day of the forward month that DLST could be active. 01 for the 1st of the month.
6	Byte	The last day of the forward month that DLST could be active. 07 for the 7th of the month.
7	Byte	Month when clock is to be moved backward one hour. 10 (0A hexadecimal) for October.
8	Byte	The first day of the backward month that DLST could be active. 25 (19 hexadecimal) for the 25th of the month.
9	Byte	The last day of the backward month that DLST could be active. 31 (1F hexadecimal) for the 31st of the month.
10-16	Byte	Filler, not used.

The example above is for an active DLST in North America.

- At 2AM on the first Sunday of April, the clock will be reset to 3AM. The first Sunday of the month could occur from the 1st to the 7th day of the month.
- At 2AM on the last Sunday of October, the clock will be reset to 1AM. The last Sunday of the month could occur from the 25th to the 31st day of the month.

Class #12 RESERVED

This class is reserved but not used at this time.

Class #13 RESERVED

This class is reserved but not used at this time.

Class #14 RESERVED

This class is reserved but not used at this time.

Class #15 OPERATING SCHEDULE EEPROM

Record size: 48
Number of records in the class: 1
Total array size: 48

This class contains the daily operating schedules. If a schedule is to be always true or on, the begin time should be 00 for the hour and 00 for the minute, the off time should be 24 for the hour and 00 for the minutes. This information is built by the PC-Config program and can be modified in a live unit.

Field definitions

Location	Type	Description
1-3	HHM MSS	Not used at this time, constant 00.
4-6	HHM MSS	Beginning hour, minute, second which is always 0 for the Sunday schedule.
7-9	HHM MSS	Beginning hour, minute, second which is always 0 for the Monday schedule.
10-12	HHM MSS	Beginning hour, minute, second which is always 0 for the Tuesday schedule.
13-15	HHM MSS	Beginning hour, minute, second which is always 0 for the Wednesday schedule.
16-18	HHM MSS	Beginning hour, minute, second which is always 0 for the Thursday schedule.
19-21	HHM MSS	Beginning hour, minute, second which is always 0 for the Friday schedule.
22-24	HHM MSS	Beginning hour, minute, second which is always 0 for the Saturday schedule.
25-27	HHM MSS	Not used at this time, constant 00.
28-30	HHM MSS	Ending hour, minute, second which is always 0 for the Sunday schedule.
31-33	HHM MSS	Ending hour, minute, second which is always 0 for the Monday schedule.
34-36	HHM MSS	Ending hour, minute, second which is always 0 for the Tuesday schedule.
37-39	HHM MSS	Ending hour, minute, second which is always 0 for the Wednesday schedule.
40-42	HHM MSS	Ending hour, minute, second which is always 0 for the Thursday schedule.
43-45	HHM MSS	Ending hour, minute, second which is always 0 for the Friday schedule.
46-48	HHM MSS	Ending hour, minute, second which is always 0 for the Saturday schedule.

Class #16 RESERVED

This class is reserved but not used at this time.

Class #17 RESERVED

This class is reserved but not used at this time.

Class #18 RESERVED

This class is reserved but not used at this time.

Class #19 RESERVED

This class is reserved but not used at this time.

Class #20 RESERVED

This class is reserved but not used at this time.

Class #21 END EEPROM

Record size:	16
Number of records in the class:	1
Total array size:	16

This class contains the visual identification of the beginning of the EEROM area, the configuration data. This class contains fixed data that is it is not changed in the PC-Config program or in a live unit.

Field definitions

Location	Type	Description
1-14	Char	**“****END OF CFG****”
15-16	Byte	Filler of 00

Class #22 CHECKSUM EEPROM

Record size: 2
Number of records in the class: 24
Total array size: 48

This class contains EEPEOM classes check sums. These check sums are developed by the PC-Config program and are used to ensure that the system has not been corrupted. Adding together each byte with in the class develops check sums for each class. The result is stored in a WORD field.

Field definitions

Location	Type	Description
1-2	Word	Check sum of class #0 BEGIN EEPROM
3-4	Word	Check sum of class #1 VERSION NUMBER EEPROM
5-6	Word	Check sum of class #2 CHILLER EEPROM
7-8	Word	Check sum of class #3 RO EEPROM
9-10	Word	Check sum of class #4 AO EEPROM
11-12	Word	Check sum of class #5 SI EEPROM
13-14	Word	Check sum of class #6 SET POINT EEPROM
15-16	Word	Check sum of class #7 MACHINE EEPROM
17-18	Word	Check sum of class #8 RESVERVED EEPROM
19-20	Word	Check sum of class #9 AUTH EEPROM
21-22	Word	Check sum of class #10 HISTORY EEPROM
23-24	Word	Check sum of class #11 RTC EEPROM
25-26	Word	Check sum of class #12 RESVERVED EEPROM
27-28	Word	Check sum of class #13 RESVERVED EEPROM
29-30	Word	Check sum of class #14 HELP EEPROM
31-32	Word	Check sum of class #15 OPERATING SCHEDULE EEPROM
33-34	Word	Check sum of class #16 BEGIN EEPROM
35-36	Word	Class not used
37-38	Word	Class not used
39-40	Word	Class not used
41-42	Word	Class not used
43-44	Word	Class not used
45-46	Word	Check sum of class #21 END EEPROM

47-48	Word	Check sum of the check sum class, not meaningful

Class #23 CHILLER RAM

Record size: 186
Number of records in the class: 1
Total array size: 186

This class contains information that is dynamically updated during running. Information dealing with the status of the chiller and circuits are stored in this class.

Field definitions for Heatcraft configuration file:

Location	Type	Description
1	Byte	Current chiller capacity control state, index pointer into an array of capacity control state names. See below for definition of this array.
2	Byte	Number of capacity steps wanted on. A number from 0 to 16.
3-6	Ulong	Time recorded in seconds that the system has been in the current chiller control state.
7-8	INT	Sensitivity timer that is incremented by an amount that is developed based upon the actual and target temperature and the slope of the actual temperature. When this value is greater than the step delay set point, a capacity step is either added or subtracted.
9-19		**THESE FIELDS APPLY TO CIRCUIT #1 (THEY WILL BE REPEATED FOR CIRCUITS 2, 3, 4, 5 & 6)**
9	Byte	Current circuit control state, index pointer into an array of circuit control state names. See below for definition of this array.
10	Byte	Number of capacity steps on this circuit that are turned on. A number from 0 to 4.
11-14	Ulong	Time recorded in seconds that the system has been in the current circuit control state.
15-16	INT	Oil differential, calculated difference between oil and suction pressure.
17-18	INT	Variable step capacity wanted on for this circuit. This is used for holding the percentage of opening of a screw compressor.
19	Byte	Used to determine if an individual circuit is disabled. This is needed with the pump control logic.
20-30		**THESE FIELDS APPLY TO CIRCUIT #2**
31-41		**THESE FIELDS APPLY TO CIRCUIT #3**

42-52		**THESE FIELDS APPLY TO CIRCUIT #4**
53-63		**THESE FIELDS APPLY TO CIRCUIT #6**
64-74		**THESE FIELDS APPLY TO CIRCUIT #6**
75-78	Long	Calculate slope of the control temperature. Difference between the current value and the temperature value based upon the slope interval time. This value is used to determine if the number of steps of capacity should be changed.
79-82	Long	Previous calculate slope of the control temperature.
83-84	INT	Calculate the average control temperature. Not used at this time.
85-86	INT	Hold the previous calculated average control temperature. Not used at this time.
87-88	INT	Variable step capacity wanted on for the entire system.
89	Byte	Number of capacity steps wanted on. A number from 0 to 16, will be equal to or one less than the number of steps wanted on.
90-91	INT	Variable step capacity actually turned on for the entire system.
92	Byte	Indicates the lead circuit (compressor). A number from 1 to 6.
93-94	INT	Condenser control slope for circuit #1.
95-96	INT	Condenser control slope for circuit #2.
97-98	INT	Condenser control slope for circuit #3.
99-100	INT	Condenser control slope for circuit #4.
101-102	INT	Condenser control slope for circuit #5.
103-104	INT	Condenser control slope for circuit #6.
105-106	INT	Current amps that the chiller is drawing.
107-108	INT	Current kw that the chiller is drawing.
109-121		**THESE FIELDS APPLY TO CIRCUIT #1 (THEY WILL BE REPEATED FOR CIRCUITS 2, 3, 4, 5 & 6) they contain information on the expansion valve.**
109	Byte	Valve control state .
110-113	ulong	State timer.
114-115	INT	Percentage of valve opening.
116-117	INT	Saturated suction temperature.
118-119	INT	Calculated super heat.
120-121	INT	Adjusted time between recalculating the needed percentage of opening of the valve.
122-134		**THESE FIELDS APPLY TO CIRCUIT #2**
135-147		**THESE FIELDS APPLY TO CIRCUIT #3**
148-160		**THESE FIELDS APPLY TO CIRCUIT #4**
161-173		**THESE FIELDS APPLY TO CIRCUIT #6**
174-186		**THESE FIELDS APPLY TO CIRCUIT #6**

Capacity control state name array

This is a one dimensional array that contains the name of the capacity state. This is a 1 to 7 ASCII characters followed by a NULL (00) character. The reference number column is shown only for reference.

Reference number	Name
1	STARTUP
2	STOPPED
3	SCH OFF
4	EVP FLW
5	CND FLW
6	AMB OFF
7	LOST IO
8	LOCKOUT
9	OFF
10	HOLDING
11	STEP -
12	STEP +
13	AMP HLD
14	KW HLD

Circuit control state name array

This is a one dimensional array that contains the name of the circuit control state. This is a 1 to 7 ASCII characters followed by a NULL (00) character. The reference number column is shown only for reference.

Reference number	Name
1	LOST IO
2	LOCKOUT
3	DISABLE
4	PMP DWN
5	ANTICYC
6	OFF
7	LUBE
8	RUNNING
9	UNLDED
10	HG LOAD
11	U1 LOAD
12	HOLDING
13	LOADING
14	UNLDING
15	LOADED
16	ST UNLD
17	SUC UNL

18	SUC HLD
19	DIS UNL
20	DIS HLD
21	SAFETY
22	TMP UNL
23	TMP HLD

Valve control state name array

This is a one dimensional array that contains the name of the valve control state. This is a 1 to 7 ASCII characters followed by a NULL (00) character. The reference number column is shown only for reference.

Reference number	Name
1	LOCKOUT
2	CLOSED
3	PREPUMP
4	STARTUP
5	SPR CTL
6	LOW SPR
7	LOW PSI

Class #24 RO RAM STATUS

Record size: 4
Number of records in the class: 48
Total array size: 192

This class contains information that is dynamically updated during running. Information dealing with the status of the relay outputs is stored in this class.

Field definitions

Location	Type	Description
1	Byte	Current status of the relay output: • 0 = on, • 1= off.
2	Byte	Not used at this time.

3	Byte	Current control status of the relay output: • 0 = AUTO, let the system determine on or off. • 1= MANON, force the relay output to on. • 2 = MANOFF, force the relay output to off. • 3 = LOCKON, the system has locked the relay output on. • 4 = LOCKOFF, the system has locked the relay output off.
4	Byte	If the relay output is to be pulsed, count of the maximum pulses to be on. Each count is 1/10 of a second on. If control algorithm time is 6 seconds then the value would be 60. If not used set to 0.

Class #25 RO RAM INFO

Record size: 28
Number of records in the class: 48
Total array size: 1344

This class contains information that is dynamically updated during running. Information dealing with the run time and cycling of the relay outputs is stored in this class.

Field definitions

Location	Type	Description
1	Byte	Last state of the relay output.
2	Byte	Not used at this time.
3-5	HHM MSS	Time that the relay output was lasted turned on.
6-8	HHM MSS	Time that the relay output was lasted turned off.
9-12	Ulong	Run time of the relay output today. This cleared at mid night.
13-14	Word	Number of cycles today. This cleared at mid night.
15-18	Ulong	Run time of the relay output yesterday.
19-20	Word	Number of cycles yesterday.
21-24	Ulong	Total run time of the relay output since the last clear point function was executed.
25-28	Ulong	Total number of cycles since the last clear point function was executed..

Class #26 AO RAM STATUS

Record size: 6
Number of records in the class: 12
Total array size: 72

This class contains information that is dynamically updated during running. Information dealing with the status of the analog outputs is stored in this class.

Field definitions

Location	Type	Description
1-2	INT	Current setting of the analog output as a percentage. Number from 0 to 1000, allow for 1 decimal place..
3	Byte	Not used at this time.
4	Byte	Control state: • 0 = AUTO, system will determine percent of opening. • 1 = MANUAL, the analog output will be set to the value that is stored in the manual value field.
5-6	INT	Manual value, this will be used when the analog output is in manual. A number from 0 to 1000, allow for 1 decimal place.

Class #27 AO RAM INFO

Record size: 20
Number of records in the class: 12
Total array size: 240

This class contains information that is dynamically updated during running. Information dealing with percentage of the valve opening is stored in this class.

Field definitions

Location	Type	Description
1-2	INT	Last state of the analog output.
3-4	INT	Today's maximum percentage open.
5-6	INT	Today's minimum percentage open.
7-10	Long	Today's average percentage open.
11-14	Long	Not used at this time.
15-16	INT	Yesterday's maximum percentage open.
17-18	INT	Yesterday's minimum percentage open.
19-20	INT	Yesterday's average percentage open.

Class #28 SI RAM STATUS

Record size: 2
Number of records in the class: 48
Total array size: 96

This class contains information that is dynamically updated during running. Information dealing with the status of the sensor inputs both analog and digital are stored in this class.

Field definitions

Location	Type	Description
		Analog input sensor
1-2	INT	Current value of the sensor. Note, all decimal places are assumed.
		Digital input sensor
1	Byte	Current status of the digital input: • 0 = on, • 1= off.
2	Byte	Not used

Class #29 SI RAM INFO

Record size: 28
Number of records in the class: 48
Total array size: 1344

This class contains information that is dynamically updated during running. Information dealing with the sensor readings of an analog sensor or the run time and cycling of a digital sensor input are stored in this class.

Field definitions for an analog sensor

Location	Type	Description
1-2	INT	Previous value of the sensor. Note, all decimal places are assumed.
3-4	INT	Today's maximum sensor reading.
5-6	INT	Today's minimum sensor reading.
7-10	Long	Today's average sensor reading.
11-14	Long	Not used at this time.

15-16	INT	Yesterday's maximum sensor reading.
17-18	INT	Yesterday's minimum sensor reading.
19-20	INT	Yesterday's average sensor reading.

Field definitions for digital sensor input

Location	Type	Description
1	Byte	Last state of the digital sensor input.
2	Byte	Not used at this time.
3-5	HHM MSS	Time that the digital sensor input was lasted turned on.
6-8	HHM MSS	Time that the digital sensor input was lasted turned off.
9-12	Ulong	Run time of the digital sensor input today, stored in seconds. This cleared at mid night.
13-14	Word	Number of cycles today. This cleared at mid night.
15-18	Ulong	Run time of the digital sensor input yesterday, stored in seconds.
19-20	Word	Number of cycles yesterday.
21-24	Ulong	Total run time of the digital sensor input since the last clear point function was executed.
25-28	Ulong	Total number of cycles since the last clear point function was executed..

Class #30 MCSIO RAM

Record size: 50
Number of records in the class: 1
Total array size: 50

This class contains information that is dynamically updated during running. Information dealing with the status and message counts of the MCS-IOS are stored in this class.

Field definitions

Location	Type	Description
1-2	Word	Continuous count of all valid messages.
3-4	Word	Continuous count of all invalid messages.
5-6	Word	Continuous count of all messages.
7-8	Word	Not used at this time.
9-10	Word	Not used at this time.

11	Byte	Dynamic count of consecutive no response from MCS-IO #1. Used to determine if MCS-IO should be marked off line.
12	Byte	Dynamic count of consecutive no response from MCS-IO #2. Used to determine if MCS-IO should be marked off line.
13	Byte	Dynamic count of consecutive no response from MCS-IO #3. Used to determine if MCS-IO should be marked off line.
14	Byte	Dynamic count of consecutive no response from MCS-IO #4. Used to determine if MCS-IO should be marked off line.
15	Byte	Dynamic count of consecutive no response from MCS-IO #5. Used to determine if MCS-IO should be marked off line.
15-16	Word	Dynamic count of consecutive valid responses from MCS-IO #1. Used to determine if off line MCS-IO should be marked on line.
17-18	Word	Dynamic count of consecutive valid responses from MCS-IO #2. Used to determine if off line MCS-IO should be marked on line.
19-20	Word	Dynamic count of consecutive valid responses from MCS-IO #3. Used to determine if off line MCS-IO should be marked on line.
21-22	Word	Dynamic count of consecutive valid responses from MCS-IO #4. Used to determine if off line MCS-IO should be marked on line.
23-24	Word	Dynamic count of consecutive valid responses from MCS-IO #5. Used to determine if off line MCS-IO should be marked on line.
25-26	Word	Count of the number of times that MCS-IO #1 has been marked off line.
27-28	Word	Count of the number of times that MCS-IO #2 has been marked off line.
29-30	Word	Count of the number of times that MCS-IO #3 has been marked off line.
31-32	Word	Count of the number of times that MCS-IO #4 has been marked off line.
33-34	Word	Count of the number of times that MCS-IO #5 has been marked off line.
35-36	Word	Status of MCS-IO #1. • 0 = off line • 1 = on line • 2 = not used

37-38	Word	Status of MCS-IO #2. • 0 = off line • 1 = on line • 2 = not used
39-40	Word	Status of MCS-IO #3. • 0 = off line • 1 = on line • 2 = not used
41-42	Word	Status of MCS-IO #4. • 0 = off line • 1 = on line • 2 = not used
43-44	Word	Status of MCS-IO #5. • 0 = off line • 1 = on line • 2 = not used
45-47	HHM MSS	Last time that MCS-IO #1 was marked as off line.
48-50	HHM MSS	Last time that MCS-IO #2 was marked as off line.
51-53	HHM MSS	Last time that MCS-IO #3 was marked as off line.
54-56	HHM MSS	Last time that MCS-IO #4 was marked as off line.
57-59	HHM MSS	Last time that MCS-IO #5 was marked as off line.

Class #31 SW STATUS

Record size: 18
Number of records in the class: 1
Total array size: 18

This class contains information that is dynamically updated during running. This class contains information as to the status of the configuration file and the software version number.

Field definitions

Location	Type	Description
1	Byte	Status of the configuration file: • 1 (true) = valid config • 0 (false) = invalid config

2	Byte	Is a down line load of the config taking place: • 1 (true) = yes • 0 (false) = no
3	Byte	Not used at this time.
4-5	Word	Not used at this time.
6-18	Char	Software version number, obtained from EEPROM.

Class #32 SPARE

This class has not been assigned at this time.

Class #33 ALARM HISTORY

Record size: 16
Number of records in the class: 60
Total array size: 960

This class contains information relating to alarm that is dynamically updated when an alarm is generated. This is a wrap around structure, the index that is required to locate the most current alarm is stored in the HISTORY_INDEX_RAM. Class #38. The latest 60 alarms are keep, once 60 alarms have been stored, the next alarm will force the oldest to be dropped.

There are 3 types of alarms:

- System alarms, these alarms are relate to a system error condition occurring, e.g. POWER RETURNED or notification of action, e.g. ROTATED LEAD #1.

- Set point alarms, these are alarms have occurred because the condition that the set point is monitoring has exceeded the time in the set point. E.g. HI DISCH PSI.

- Sensor alarms, these alarms occur when a sensor has been shorted or is open. The sensor reading is no longer valid.

Field definitions

Location	Type	Description
1	Byte	Number that indicates the circuit, sensor number, MCS-IO# or not used. This will be displayed with the alarm for certain types that require additional information.
2	Byte	• Index if less than 60, index into an array of alarm names. These alarms are system alarms. Refer to System Alarm array definition below. • Index if greater or equal to 60 but less than 120, index into the set point array to get the alarm name. These alarms have been generated based upon a set point. • Index if greater than 120, index into the sensor array to get the sensor name that has failed.
3	Byte	Hour that the alarm occurred. This is military time.
4	Byte	Minute that the alarm occurred.
5	Byte	Second that the alarm occurred.
6	Byte	Month that the alarm occurred.
7	Byte	Day of the month that the alarm occurred.
8	Byte	Day of the week that the alarm occurred.
9-14	Byte	Not used at this time.
15-16	INT	Not used at this time.

System Alarm name array

This is a one-dimensional array that contains the name of the system alarm. This is a 1 to 16 ASCII characters followed by a NULL (00) character. The reference number column is shown only for reference.

Reference number	Name
1	POWER FAILED
2	COMPUTER RESET
3	BATTERY FAILED
4	LCD FAILURE
5	HW DATE INVALID
6	HW TIME INVALID
7	SW DATE INVALID
8	SW TIME INVALID
9	ALARMS CLEARED
10	POWER RETURNED
11	RAM INTEGRITY
12	STPT CHANGED
13	RO MANUAL
14	AO MANUAL
15	SI MANUAL
16	POINT INFO CLEAR

17	CLOCK SET
18	CFG DOWNLOADED
19	ROTATED LEAD\0
20	METER CLEARED
21	INVLD ALGO STATE
22	INVLD RO MAN
23	INVLD CFG FLAG
24	CPURAM INTEGRITY
25	INVLD AO MAN
26	DAYLIGHT SAVINGS
27	(spaces, not used)
28	(spaces, not used)
29	MCS-RO8 #1 LOST
30	MCS-RO8 #2 LOST
31	MCS-RO8 #3 LOST
32	INVALID CONFIG
33	INVALID CFG VER
34	MCS-I/O #1 LOST
35	MCS-I/O #2 LOST
36	MCS-I/O #3 LOST
37	WATCHDOG RESET
38	SENSOR FAULT
39	EMERGENCY STOP
40	SMOKE ALARM LOCK
41	NO AIR FLOW LOCK
42	COMP1 PROOF LOCK
43	AMBIENT SENSOR
44	PHASE LOSS
45	MOTOR OIL SENSOR
46	DISCHARGE SENSOR
47	SUCTION SENSOR
48	COMP OIL SENSOR
49	MOTOR TMP SENSOR
50	MOTOR RPM SENSOR
51	LOST IO SHUTDOWN
52	HEAT PROOF FAULT
53	INVALID CFG TYPE
54	PWR FAIL LOCKOUT
55	LOST I/O RESTART
56	COMP2 PROOF LOCK
57	LOW SUPERHT
58	HI DUCT STATIC
59	MCS-SI8 #1 LOST
60	MCS-SI8 #2 LOST
61	MCS-SI8 #3 LOST

Class #34 MACHINE RAM

Record size: 16
Number of records in the class: 1
Total array size: 16

This class contains information that the system uses to keep track of the MCS-IO that is being acessed. It also tracks the number of power failures that the system has encountered. This information is only useful to the control algorithm.

Field definitions

Location	Type	Description
1-4	Byte	Not used at this time.
5	Byte	Continuous counting of the number of power failures.
6-14	Byte	Not used at this time.
15	Byte	Address, 0 through 5, of the current MCS-IO that is being accessed.
16	Byte	Hardware version number

Class #35 RTC RAM

Record size: 46
Number of records in the class: 1
Total array size: 46

This class contains real time clock information. It is updated by reading the real time clock settings into this class upon power up. If the real time clock contains valid data, it is then moved into the SW TIME RAM class, software clock. If the data is not valid, then the data that had been stored in the SW TIME RAM class is loaded into this class and the real time clock. This class is referenced whenever the time or date information is needed.

Field definitions

Location	Type	Description
1-32	Byte	Not used at this time.
33	Byte	Current second.
34	Byte	Current minute.
35	Byte	Current hours.
36	Byte	Current day of the week.
37	Byte	Current day of the month.
38	Byte	Current month.
39	Byte	Current year.
40-46	Byte	Not used at this time.

Class #36 SW TIME RAM

Record size: 12
Number of records in the class: 1
Total array size: 12

This class is reserved for use by the MCS control algorithm.

The software clock is maintained in this class.

Field definitions

Location	Type	Description
1	Byte	10 milla-second timer.
2	Byte	100 milla-second timer.
3	Byte	Current second ticker.
4	Byte	Current minute ticker.
5	Byte	Current hours ticker.
6	Byte	Old second ticker.
7	Byte	Not used at this time
8	Byte	Current day of the week.
9	Byte	Current day of the month.
10	Byte	Current month.
11	Byte	Current year.
12	Byte	Current year.

Class #37 SPARE

This class has not been assigned at this time.

Class #38 HISTORY POINTERS

Record size: 12
Number of records in the class: 1
Total array size: 12

This class dynamically keeps track of where the current sample is to be stored in the HISTORY RAM class and where the next alarm will be stored in ALARM HISTORY class. This class is used in conjunction with the HISTORY RAM class to display history and with the ALARM HISTORY class to display the alarms.

Field definitions

Location	Type	Description
1	Byte	Not used at this time.
2	Byte	Filler, not used. Places word on the proper boundary.
3-4	Word	Not used at this time.
5-6	Word	Relative index to the first history sample. This is used to determine when the samples have filled the structure that holds the samples. Oldest sample will be replaced.
7-8	Word	Relative index to the last, most recent, history sample. This index is stepped after each sample is added.
9-10	Word	Not used at this time.
11	Byte	Relative index to the first alarm. This is used to determine when the alarm have filled the structure that holds the alarm. Oldest alarm will be replaced.
12	Byte	Relative index to the last, most recent, alarm. This index is stepped after each alarm is added.

Class #39 HISTORY RAM

Record size: 112
Number of records in the class: 144
Total array size:

This class contains the actual history sample. Status of all points and states are captured. This is dynamically updated at the sample time interval.

Field definitions

Location	Type	Description
1-3	HHM MSS	The time of this sample.
4	Byte	Index that points to the control state of the system.
5	Byte	Relay output settings for the 8 ROS on MCS-8.
6	Byte	Relay output settings for the 8 ROS on MCS-I/O #1.
7	Byte	Relay output settings for the 8 ROS on MCS-I/O #2.
8	Byte	Relay output settings for the 8 ROS on MCS-I/O #3.
9	Byte	Relay output settings for the 8 ROS on MCS-I/O #4.
10	Byte	Relay output settings for the 8 ROS on MCS-I/O #5.
11-34	INT	Analog output percentage opening for AO #1 through AO #12.

34-130	INT	Sensor input #1 analog value. The type of input either digital or analog and if analog, type of sensor must be determined from the SI class. This is repeated for SI's 2 through 48.
131-134	Long	Calculate control slope.
135	Byte	Number of capacity steps that the system wants on.
136	Byte	Number of capacity steps that the system has turned on.
137-138	INT	If variable capacity, this is the percentage wanted.
139-144		**FOLLOWING INFORMATION IS FOR CIRCUIT #1.**
139	Byte	Control state for circuit #1.
140	Byte	Number of steps turned on in circuit #1. Number from 0 to 4.
141-142	INT	Calculated oil differential if it exists for circuit #1.
143-144	INT	If variable capacity, this is the percentage wanted for circuit #1.
145-150		**ABOVE INFORMATION REPEATED FOR CIRCUIT #2.**
151-156		**ABOVE INFORMATION REPEATED FOR CIRCUIT #3.**
157-162		**ABOVE INFORMATION REPEATED FOR CIRCUIT #4.**
163-168		**ABOVE INFORMATION REPEATED FOR CIRCUIT #5.**
169-174		**ABOVE INFORMATION REPEATED FOR CIRCUIT #6.**

Class #40 RAM BEG MARK

Record size: 9
Number of records in the class: 1
Total array size: 9

This class contains a static marker, 'RAM BEGIN'.

Class #41 RAM CFG MARK

Record size: 7
Number of records in the class: 1
Total array size: 7

This class contains a static marker, 'RAM CFG.

Class #42 RAM END MARK

Record size: 7
Number of records in the class: 1
Total array size: 7

This class contains a static marker, ‘RAM END.

Class #43 RAM AD RAW

Record size: 2
Number of records in the class: 8x10
Total array size: 160

This class contains raw analog to digital, AD, counts. The class is structured to hold 10 individual scans or AD counts from 8 input channels. From these counts a weighted average or filtered counts are developed, refer to Class #45. This information is build by each MCS board, both the MCS-8 and the MCS-IO boards.

Field definitions

Location	Type	Description
1-2	Word	Raw AD count for first scan for the first channel
3-20	Word	Raw AD count for the first channel, scans 2 through 10.
21-160		Above information is repeated 7 times for channels 2 through 8.

Class #44 SPARE

This class has not been assigned at this time.

Class #45 RAM ALGO FILTERED

Record size: 2
Number of records in the class: 8 if MCS-IO
Total array size: 16 if MCS-IO
Number of records in the class: 48 if MCS-8
Total array size: 96 if MCS-8

This class contains the filtered AD count for each channel. The MCS-IO's develop this class and then transmit it to the MCS-8 when requested. The MCS-8 will hold all of the filtered AD counts, maximum of 48, and then convert the counts into meaningful information based upon the sensor type associated with each channel.

Field definitions

Location	Type	Description
1-2	Word	Filtered AD count for sensor input #1 based upon the 10 raw AD counts. The filtered AD count is developed every second.
3-96		Repeated for sensors #2 through #48.

Class #46 RAM OUTPUT IMAGE

Record size: 14
Number of records in the class: 6
Total array size: 84

This class contains information as to the relay and analog output status for each MCS board. The first record is for the MCS-8 and records 2 through 6 are for MCS-IO #1 through #5. The information is build by the MCS-8 and then transmitted to each MCS-IO for it to take the appropriate action. Turning on or off relay outputs, pulsing relay outputs and pulsing analog output.

Field definitions

Location	Type	Description
1-2	Word	Relay output status in bit format. If on, bit = 0 else bit =1. Counting the bits from right to left to and beginning with 0, bit 0 will have the status of the first RO. Bit 1 will have the second RO status and so on. Bits 8 through 16 are not used and are filled with 0.
3-4	Word	This is the number of counts that the AO #1 should be held on. This is updated every second.
5-6	Word	Repeated for AO #2.
7	Byte	If the relay output #1 is to be pulsed, this is the number of counts that the RO should be held on. This is updated every second.
8-14	Byte	Repeat of previous field for relay outputs 2 through 8.

Class #47 RS232 RAM

Record size: 10
Number of records in the class: 1
Total array size: 10

This class contains information that is dynamically updated during running. Information dealing with the status and message counts of the RS232 port are stored in this class.

Field definitions

Location	Type	Description
1-2	Word	Count of the valid messages that have been received over the RS232 port.
3-4	Word	Count of the invalid messages that have been received over the RS232 port.
4-6	Word	Not used at this time.
7-8	Word	Count of the valid messages that have been transmitted over the RS232 port.
9	Byte	Not used at this time.
10	Byte	Not used at this time.

Class #48 RS485 RAM

Record size: 10
Number of records in the class: 1
Total array size: 10

This class contains information that is dynamically updated during running. Information dealing with the status and message counts of the RS485 port are stored in this class.

Field definitions

Location	Type	Description
1-2	Word	Count of the valid messages that have been received over the RS485 port.
3-4	Word	Count of the invalid messages that have been received over the RS485 port.
4-6	Word	Not used at this time.
7-8	Word	Count of the valid messages that have been transmitted over the RS485 port.
9	Byte	Not used at this time.
10	Byte	Not used at this time.

Class #49 SETPOINT RAM

Record size: 2
Number of records in the class: 60
Total array size: 120

This class contains the current value of the set point.

Field definitions

Location	Type	Description
1-2	INT	Value of the set point. Decimal places are assumed.

Class #50 METER RAM

Record size: 86
Number of records in the class: 1
Total array size: 86

This class is only used in the HOME algorithm code.

Class #51 METER HISTORY

Record size: 468
Number of records in the class: 1
Total array size: 468

This class is only used in the HOME algorithm code.

Class #52 RESERVED

Class #53 RO RAM EXTRA

Record size: 1
Number of records in the class: 48

Total array size: 48

This class dynamically updated and it contains information for pulsed relay outputs.

Field definitions

Location	Type	Description
1	Byte	For pulsed relay outputs, this will be the manual percentage of opening. Value will only be used when the relay is placed in manual. This value can be updated in a running unit.

Class #54 LOCKOUT HISTORY RAM

** not available with the six board algorithm **

Record size: 8
Number of records in the class: 31
Total array size: 248

This class contains information that relates to the circuit that caused the lockout. This structure is similar to the alarm history structure class #33. It is accessed in the same matter.

Field definitions

Location	Type	Description
1	Int	Suction PSI of circuit that has caused lock out.
2	Int	Discharge PSI of circuit that has caused lock out.
3	Int	Oil differential PSI of circuit that has caused lock out.
4	Int	Amps of circuit that has caused lock out.
5	Int	Suction temperature of circuit that has caused lock out.
6	Int	Discharge temperature of circuit that has caused lock out.
7	Int	Oil temperature of circuit that has caused lock out.
8	Int	Motor temperature of circuit that has caused lock out.