Honeywell

Excel Plus OpenLink

FOR MODBUS (S1069)

APPLICATION GUIDE

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74-3394

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1. INTRODUCTION

1.1 PRODUCT OVERVIEW

The intent of the Excel Plus OpenLink Modbus interface (S1069) is to allow Modbus compatible controllers to be interfaced into the Excel 5000 XBSi system by means of the Excel Plus (R7044) Controller and CNI daughter board. The Modbus Network will be directly connected to the CNI board.

The Excel Plus OpenLink Modbus interface can support the transfer of up to 1800 unique Modbus network values into the Excel 5000 XBSi system via the R7044 controller and CNI board. This is accomplished by using the Excel Plus OpenLink Modbus Configuration Tool (S641) and the Honeywell CAE engineering tool. The R7044 datafile will be created using the Honeywell CAE engineering tool while the database for the Modbus interface software residing on the CNI board will be created by using the Modbus Configuration Tool. The Modbus communication software residing in EPROM on the CNI board will utilize both the CAE and Modbus Configuration tool databases to determine what Modbus network controllers and points need to be scanned. Only the point values from the Modbus network controllers will be transferred to the Excel Plus (R7044) controller. The R7044 controller may have 255 local points in addition to points from the Modbus network.

This guide contains only general information on installing, configuring or operating Modbus Protocol compatible controllers. It assumes that the user is already familiar with the specific Modbus controllers that are being used and has the necessary Modbus installation, operation and maintenance manuals.

1.2 USE OF THIS MANUAL

This Application Guide is to be used as a reference manual in laying out the hardware and software for any job site that intends to use the Excel Plus OpenLink Modbus interface. It requires that the reader have in his possession the manuals and forms listed under APPLICABLE LITERATURE. These manuals and forms are required in order to properly install and operate the interface. This guide is a combination document that contains the Application Guide, the Installation Guide and Checkout & Test documentation. This document and the Modbus Configuration Tool Users Guide will be the sole reference documents provided for this interface.

1.3 APPLICABLE LITERATURE

The following is a list of potentially useful manuals and documents. Some of these documents may or may not be required depending on the specific engineering requirements.

Form Number	Title
	DeltaNet System:
74-2529	DGC System Summary
74-1012	Software Release Bulletin
74-2529	DeltaNet Gateway Check Out and Test
74-3536	DGC Graphics Operator's Manual
74-3878	DeltaNet Micro Central Excel Plus System Application Guide
74-3541	DeltaNet Graphic Central Overview/Operator Manual
	Excel Building Supervisor Integrated System:
74-2034	Specification Data
74-3600	Software Release Bulletin
74-1381	Bus Interface and CSS Check Out and Test
74-1200	Operator Manual
74-1260	Graphics Operator Manual
	Excel Plus Controller:
74-3882	R7044 Excel Plus Controller Hardware Spec. Data Sheet
74-2373	R7044 Excel Plus Controller Software Spec. Data Sheet
74-5152	R7044D, E, F Excel Plus Functional Drawings
74-2548	R7044 Excel Plus Application Guide
85-0160	Excel Plus Controller (A-G) Maintenance & Repair
95-7441	Excel Plus Controller, CNI Installation Instructions
	Computer Aided Engineering (CAE):
74-3894	DeltaNet Micro Central/Excel Plus PC CAE Utility Manual
	Modbus OpenLink Interface Manuals
74-xxxx	Excel Plus OpenLink Modbus Configutation Tool User Guide
74-xxxx	Excel Plus OpenLink Modbus Configutation Tool SRB
14006090-453440	Excel Plus OpenLink Modbus Application Guide
74-xxxx	Excel Plus OpenLink Modbus Application Guide SRB

	Modicon Inc. One High Street North Andover, MA 01845
PI-MBUS-300 Rev. D	Modicon Modbus Protocol Reference Guide

	Power Measurement LTD. (PML) 2195 Keating Cross Road British Columbia, Canada V8M 2A5
70100-0002	3300 ACM Data Sheet
70000-0012	3300 ACM Installation & Operation Manual
70020-0009	3300 ACM Modicon Modbus Serial Com. Protocol
	ABB Industrial Systems Inc. Standard Drives Division 16250 W. Glendale Drive New Berlin, WI 53151
ACS500-MODBUS	ACH 500 Modbus Protocol Manual
ACH501-05	ACH 501 Programming Manual
ACH501-04	ACH 501 Installation & Start-up Manual

1.4 TERMS AND ABBREVIATIONS

For readability of this document the following terms are used:

CAE - Computer Aided Engineering - shall refer to both CAE and customer program pak (release 4.5 or greater) unless specifically excluded.

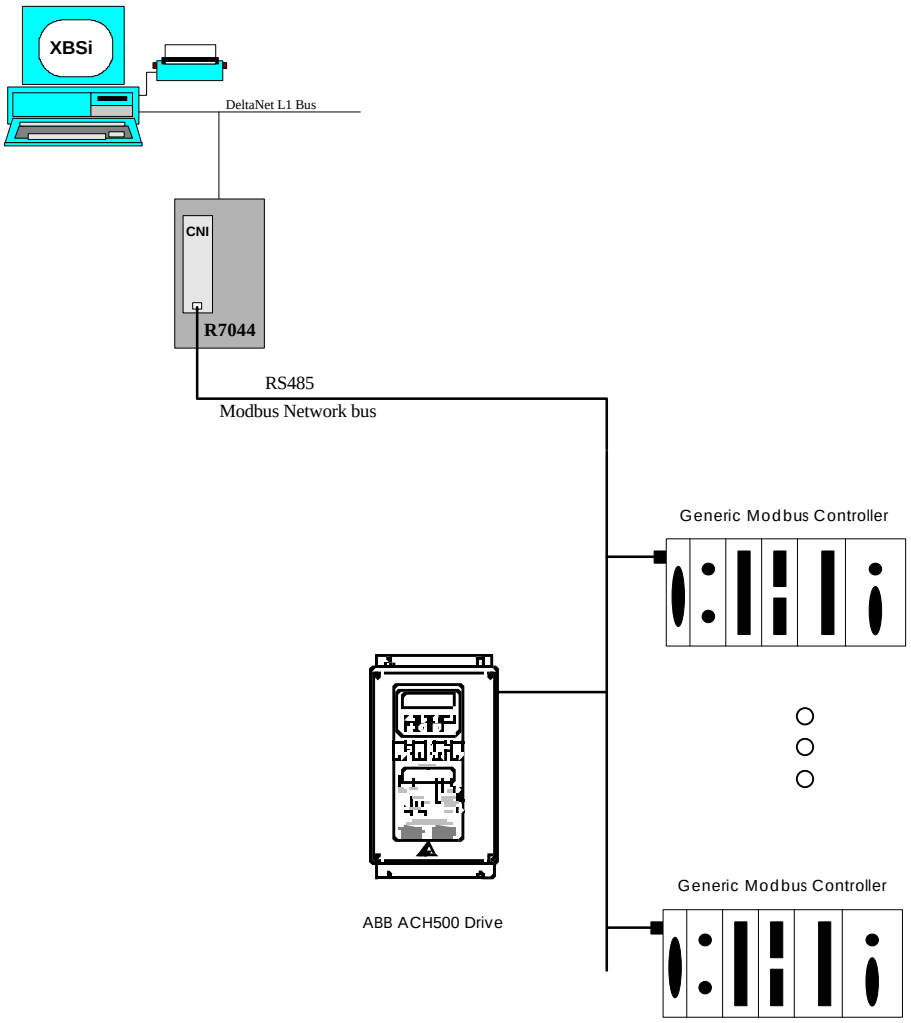
CNI - C-NAP Network Interface is the board that is installed in the R7044 controller D, E or G and will communicate on the vendor bus for this interface.

Vendor bus - is the connection between the CNI board and the RS485 port of the Modbus controllers.

Vendor devices - shall refer to the actual Modbus controllers.

2. SYSTEM ARCHITECTURE

The Excel Plus OpenLink Modbus interface software (S1069) will reside on the CNI board in a single 512K EPROM. The specific Modbus database generated by the Modbus Configuration tool will reside in 1 or 2 ATMEL AT28C256 EEPROMS on the CNI board. The CNI will be attached per standard application off the R7044 motherboard. The Modbus network will connect to the CNI via the RS485 port on the CNI. A general block diagram showing how the Modbus network will interface to the existing Honeywell Excel 5000 system is as follows:



3. INTERFACE FUNCTIONALITY

The Excel Plus OpenLink Modbus interface is a communications vehicle which allows for the integration of Modbus compatible devices to the Excel 5000 XBSi system. In general, the interface is "seamless" in that any interfaced point appears to the Excel 5000 XBSi system just like any other "true" Excel 5000 XBSi system point. Specifically any local or central OI that can access MicroCel points shall be able to access the OpenLink interface points. This interface did not add functionality to any OI or device, present or future, that does not provide "access ability" to MicroCel type points.

3.1 SYSTEM OPERATION

The key system functionality shall include:

1. The R7044 controller may have up to 255 local points. In addition, the controller can support up to 1800 unique mapped points from the interfaced subsystem, in a single CNI board, as long as sufficient RAM is available on the R7044 controller and in the CNI resident database EEPROMS.

2. This interface will allow for up to 99 vendor devices per CNI datafile. (See Section 5.0) The vendor device number will be a function of the R7044 subdevice number (ss in the R7044 address format of cc.bbb.dd.ss.ppp). Each R7044 subdevice can consist of up to 149 vendor points consisting of both analog and digital point types. (See Section 5.0 for ss number requirements and limitations.)

3. Only the point values from the Modbus subsystem points will be transferred to the R7044 controller.

4. Capability to read selected point data at the operators discretion from any Excel 5000 XBSi system local or central OI.

5. Capability to command selected points (as long as these are commandable points in the Modbus system) at the operators discretion from any XL5000 XBSi system local or central OI as follows:

    5.1. Digital points - Off / On (0=OFF, 1=ON)
    5.2. Analog points - value within a range (-9999.9 to 99999.9***)***

6. The XL5000 XBSi system can annunciate, acknowledge, and archive critical alarms from the mapped points of the interfaced subsystem at central OIs.

7. Capability to prioritize alarms from the mapped points of the interfaced subsystem relative to other alarms in the XL5000 XBSi system.

8. That CAE will be used to create and modify the database used for the R7044 (HPEP) controller and the portion which is downloaded to the CNI board and the OpenLink Modbus Configuration Tool will be used to create and modify the database resident in the EEPROM chips on the CNI board. The first vendor point (R7044 Point 001 for each dubdevice), for each vendor device must be programmed, however; the remaining vendor points are optional. . Only legal low MicroCel addressing will be allowed. The exact point mapping procedures will be covered later in this Application Guide.

9. Capability to include selected subsystem points within the confines of the Excel 5000 XBSi historical storage capabilities (just as if it were a true Excel Plus MicroCel controller family point) and also trends.

10. The points from the interfaced subsystem can act as initiators for global commands in the Excel 5000 XBSi system. A maximum of 16 R7044 initiators from the interfaced system is allowed. The ability to be receptors is beyond the scope of this product. The only way for the vendors system to obtain information from the Excel 5000 XBSi system is through a command. The vendors subsystem will not be able to request or obtain Excel 5000 point information.

11. Capability for any point in the interfaced subsystem to be included on any graphic, contained within any schedule, etc. just as though it were a "true" MicroCel system point.

12. The Vendor Modbus will attach directly to the RS485 terminals on the CNI board.

13. No command override processing is allowed for the interfaced subsystem. The MicroCel system allowed command override capability at the MicroCel controller level. Since the Excel 5000 XBSi thinks the vendor points are MicroCels it will allow command override capability. This function is not available for the Modbus vendor subsystem.

14. DDC programs and TEP's will be able to issue commands to the controller units. The maximum thruput rate is one command per second. This includes both types of methods DDC programs and TEPs. In addition, there are only 30 command slots available for the storage of pending command messages per CNI board. The user must be careful not to exceed the design limits of the command buffers and message thruput to an individual CNI board.

15. Vendor bus response times are not within our control. The specific timing depends on the number of points that are mapped and the number of point that may be read from a vendor controller at one time.

16. No R7044 controller point information will be sent as global data to interfaced subsystem.

17. The time of day or date information will not be sent to interfaced subsystem.

18. Any "No Response" of vendor device images shall be annunciated in a manner consistent with R7044 subdevices.

19 The protocol to be used shall be the Modbus PI-MBUS-300 Rev. D protocol supplied by Modicon Inc.

3.2 FAILURE/ERROR MODES

The Excel Plus OpenLink product displays error conditions on the CNI 7-segment display so that field installations may more quickly determine what problem may exist in the interface and also so they can determine that the interface is running. The following conditions will be displayed momentarily on the 7-segment display:
Note: Only these codes are displayed.

5 - no response from all subsystem devices.
7 - request failed, retry request
8 - no response from a single subsystem device
E - Invalid Group Requested from R7044 controller

The startup conditions of the CNI and what shall be displayed on the 7-segment display are as follows:

1 - Initializing.
2 - Not enough local database RAM.
3 - Bad RAM chip.
4 - Bad OS EPROM chip - checksum error.
F - Bad CAE Database - check CAE
⌊_⌋ - Bad Modbus Database EEPROM, Page 7
⌈¯⌉ - Bad Modbus Database EEPROM, Page 6
] - Bad Modbus Database EEPROM, Page 5
[- Bad Modbus Database EEPROM, Page 4

3.4 COMMUNICATION INTERFACE REQUIREMENTS

1. The protocol to be used shall be a subset of the Modbus PI-MBUS-300 Rev. D protocol supplied by Modicon Inc.

2. The Supported Modbus Messages are as follows:

1. Messages (Queries) supported:

01 = Read Coil Status
02 = Read Input Status
03 = Read Holding Registers
04 = Read Input Registers
05 = Force Single Coil
06 = Preset Single Register
15 = Force Multiple Coils
16 = Preset Multiple Coils
20 = Read General Reference
21 = Write General Reference

4. APPLICATIONS

The OpenLink interface product uses the CNI board (HPEP C-NAP Network Interface 14506839 kit). This board may be installed in R7044 controller D, E, or G Excel Plus Controllers.

The point values from the Vendor's Modbus subsystem are updated to the R7044 controller in a manner similar to that of MicroCel points. The points may be manipulated in the R7044 controller similar to any MicroCel point with the following exceptions:

- There is no global point update to the Vendor bus or points on that bus.
- There is no internodal point update done by the CNI for the Vendor system. Hence there is no point sharing for Vendor data like that done for CNAP.
- There is no Fixed (command override) processing for the Vendor devices. Be careful not to write an application that relies on override not to cancel the last command issued.

4.1 TYPICAL APPLICATIONS

It is expected that the typical Vendor interface application will be to monitor the values obtained from the Vendor devices. In addition, commands will be allowed to vendor points that are defined, in the Honeywell system, to be either Analog or Digital output points.

If the installation requires alarms at the Excel 5000 XBSi central from the Vendor devices, the high and low alarm values must be entered via CAE. In this way the R7044 controller will process the values returned from the device and annunciate the proper conditions throughout the system.

4.2 CUSTOM APPLICATIONS

Custom applications would need to be written in DDC on a as needed basis. Remember that the Vendor device points will look like pseudo points in the R7044 controller.

5. SYSTEM PLANNING

In order to effectively plan the layout or program a database for the Vendor interfaced system, a general understanding is needed as to how points and devices are mapped between the Vendor system and the Honeywell system. First let us review the Excel Plus (R7044) controller point and device/subdevice method and limitations.

R7044 controller Point Capabilities

The R7044 controller supports approximately 5000 points in a single CNI board as long as sufficient RAM is available on that R7044 controller and CNI board. There is no limit as to the number of analog or digital points other than the maximum point count as long a sufficient memory is available in the R7044 controller. The R7044 controller allows for up to 99 Modbus controllers per CNI board.

The Modbus Configuration tool will configure up to 30 group templates (point lists) which can contain up to 149 unique Modbus point addresses each (or a total of 1800 points) that may be applied to specific R7044 subdevices (ss).

The link between the group templates and the CAE database is the value programmed in the cnapnt for point number 1 in each R7044 subdevice. The number used for cnapnt for R7044 ss point number 1 will direct the communication software to use the group template point list indexed by that value.

Examples of subdevices are:

R7044 Point address CC.BBB.DD.SSPPP	CAE cnapnt	Template Number	Template Point Number
05.001.30.01001	2	2	1
05.001.30.01002	see tool report	2	2
05.001.30.01030	see tool report	2	30
05.001.30.01032	see tool report	2	32

Where 05.001.30 is the address of the R7044 controller containing the Excel Plus OpenLink Modbus Interface. The vendor point number is associated with the R7044 PPP, please refer to Appendix A for the association matrix.

Note: The R7044 Point Number PPP must match the PT number (first column) in the Modbus Configuration Tool Report.

Point Mapping from Modbus to R7044 controller

Each Modbus device image has a specific point layout. This layout (group template) is created by using the Modbus Configuration tool and must be referenced to CAE the datafile for each specific job. **Remember, the first point, for each device image , must be entered in CAE for the system to function properly.** The remaining points are optional.

5.1 CNI MEMORY SIZING

Each Vendor device image requires (1 + (8 * number of mapped points)) bytes of RAM. A maximum system could have 99 vendor images. The board is shipped with 16,384 bytes of RAM for point datafile. So, a second RAM chip could be needed for large data files. See diagram in Appendix B for chip locations on the CNI board or refer to 95-7441 or 85-0160.

In addition, creating large numbers of subdevice points in CAE does affect the generated EPROM size for the R7044 controller containing the CNI board. Refer to HPEP & MicroCel CAE literature for sizing guidelines and any additional installation requirements for CAE generated EPROMS.

5.2 PHYSICAL BUS LIMITATIONS

The Vendor bus will connect to the CNI either directly or through the RS232 / RS485 converter. If you use AK3702R cable, the RS485 portion of the link may be up to 4000 feet in length. If you use Belden 9533 cable, the RS232 portion of the link may be up to 50 feet in length.

6. SYSTEM PROCUREMENT

6.1 THIRD PARTY SUPPLIED COMPONENTS

- The RS485/RS232 converter is a B & B 485TBLED converter or equivalent.

  B & B Electronics
  Manufacturing Company
  Ottawa, IL 61350

  This item is available from Honeywell Special Projects Engineering as part number 14006090-263600.

6.2 SOFTWARE COMPONENTS

- 27c512 EPROM containing the Honeywell Excel Plus OpenLink Modbus interface software is available from Honeywell as part number S1069.

6.3 DOCUMENTATION/MANUALS

A list of applicable documents and their source are detailed in the APPLICABLE LITERATURE section of this document.

It is expected that the Honeywell branch will maintain any forms or other documents relating to the installation of the specific system.

No custom data sheets or forms are supplied for datafile programming of the Vendor interface

7. INSTALLATION & SYSTEM CONFIGURATION

7.1 COMPUTER AIDED ENGINEERING (CAE)

The first step, before the CAE process can be accomplished is to use the OpenLink Modbus Configuration tool to create the group templates required for this specific job. (Refer to the OpenLink Modbus Configuration Tool User Guide for more information.) The Excel Plus OpenLink Modbus Interface requires that first point be programmed in CAE and the remaining points are optional for all device images that are to be accessed on the interface bus. CAE will automatically bring up the MicroCel templates when programming an R7044 controller point . The instructions that follow will relate to those MicroCel point templates.

The first step is to decide which R7044 controller will contain the CNI board. Use that R7044 controller device gateway, bus and device address when entering the Vendor device image datafile in CAE. Program the **proc** record for that R7044 controller in CAE first before proceeding to programming of the Vendor subdevices.

Define the subdevice address of the Vendor device

Each Vendor device image is addressed as a subdevice to the R7044 controller similar to MicroCels. A maximum of 99 subdevices may exist in the R7044 controller. CAE will take care of deciding the HIGH/LOW MicroCel subdevice programming by using the point number (ppp) that was entered when the full point address was entered. When you program the first point for that subdevice CAE will take care of setting up that subdevice in the datafile for that R7044 controller. The cnapnt number

assigned for R7044 point number 1 in any subdevice will link that subdevice with a specific group template generated by the Modbus Configuration tool. There is no separate subdevice record programming in CAE.

Vendor device point programming

The specific parameters and point order for each device is listed in a report generated by the Modbus Configuration tool. The first point **MUST** be programmed, however; the remaining points are optional.

To begin programming the Vendor points, the point type must be selected for the point to be programmed. This is the DI, DO, AI, AO listed for that point. Do not use the **dev** (non standard point device) programming - use **pnt**. Select the appropriate CAE menu and proceed.

The first field that must be entered is the **cnapnode** field. This entry will contain the actual Vendor device image address plus an offset. (Use ss + 50, or SS + 150, refer to report generated by Modbus Configuration tool)

The next field is **cnapnt.** Enter the CNAP POINT NUMBER from report generated by Modbus Configuration Tool for the device type being programmed.

The screens for analog and digital points are different. Specific entries for these point types are given in the corresponding sections that follow. Entries that are at the option of the user such as descriptor will not be discussed and may be entered with whatever value(s) are appropriate for the system being installed.

DI - Digital Input Point (pnt.di - record type)

Each digital input point must have the certain fields programmed in the following manner:

spare Spare record. Enter "n".

use Point use. Enter "misc".

euk Engineering Unit - enter the appropriate CAE EU Key listed Appendix B. ***Be very careful not to enter a three position unit as the point processing will be incorrect when the system is running.***

cnapeuk CNAP engineering unit. Enter "1". (1 for fon)

apt Alarm point. Enter "y" or "n" as required. A "n" (no) in this field will stop alarm messages for any state being issued.

The following 8 fields are conditional on apt = "y"

almst Engineering unit state for alarm. For example, if a point going OFF is an alarm, then enter "off" into this field.

almpr Alarm Priority (1 to 31). Enter "1" to "31". Alarm priority 1 is the highest priority. High priority alarms display first and replace alarms of lower priority in the alarm area.

almcl Alarm Classification (1 to 4). Enter "1" to "4".
See 74-2548 for more details.

urgent Should point going into alarm cause a dialup? Enter "y" or "n". This field is used for the R7044 dialup configuration.

alm Alarm message number (1 to 9999). Enter "1" to "9999".

lkpnt Lockout point address. Enter point address "cc.bbb.dd.ss.ppp" where cc.bb.dd.ss of the point being alarm locked out MUST be the same as this point. The lockout point is a digital point whose state inhibits alarms from this point (the one being currently programmed in pnt.di)

lkst Lockout state. Enter the digital state that inhibits alarms from this point. (ie. "off" or "on").

lkdly Lockout Delay (1 to 90 minutes). Enter "1" to "90". See 74-2548 for more details.

runtp Run Time for point. If required enter "cnt". It is not suggested to use runtime counts for subsystem points due to the delay time for obtaining updated point information.

The following 3 fields are conditional on runtp = "cnt"

rtchk Perform runtime check? Enter "y" or "n". If "n" count continues, but software never checks it. If reaching a maximum value must initiate a message or control a TEP, then enter "y".

maxrt Maximum state transition count (1 to 600,000). Enter "1" to "600000". When the point accrues the specified number of state transitions, software issues an alarm containing the specified runtime message text.

run ID number of an item in the Runtime Message Table (1 to 9999). Enter "1" to "9999". See 74-3878 for table details.

segid Segregation index number. Enter as appropriate.

des Point descriptor ID number. Enter as appropriate.

pd Point description. Enter as appropriate.

DO - Digital Output Point (pnt.do - record type)

Each digital output point must have the certain fields programmed in the following manner:

spare Spare record. Enter "n".

use Point use. Enter "misc".

euk Engineering Unit - enter the appropriate CAE EU Key listed Appendix B. ***Be very careful not to enter a three position unit as the point processing will be incorrect when the system is running.***

cnapeuk CNAP engineering unit. Enter "1". (1 for fon)

runtp Run Time for point - if required enter "cnt". It is not suggested to use runtime counts for subsystem points due to the delay time for obtaining updated point information.

The following 3 fields are conditional on runtp = "cnt"

rtchk Perform runtime check? Enter "y" or "n". If "n" count continues, but software never checks it. If reaching a maximum value must initiate a message or control a TEP, then enter "y".

maxrt Maximum state transition count (1 to 600,000). Enter "1" to "600000". When the point accrues the specified number of state transitions, software issues an alarm containing the specified runtime message text.

run ID number of an item in the Runtime Message Table (1 to 9999). Enter "1" to "9999". See 74-3878 for table details.

segid Segregation index number. Enter as appropriate.

des Point descriptor ID number. Enter as appropriate.

pd Point description. Enter as appropriate.

AI - Analog Input Point (pnt.ai - record type)

Each analog input point must have the certain fields programmed in the following manner:

spare Spare record. Enter "n".

use Point use. Enter "misc".

euk Engineering Unit - enter the appropriate CAE EU Key listed Appendix B.

decpl Number of decimal places (0 to 5). Enter a value to display vendor specific format. (Decimal place of 0 = XXXXXX. , where 5 = X.XXXXX)

almck Alarm point flag (0 to 4). Enter "0" to "4".

Flag	Description
0	No Alarm
1	Fixed Alarm limits, 1 set
2	Fixed Alarm limits, 2 sets
3	Floating Alarm limits, 1 value
4	Floating Alarm limits, 2 values

If point is not assigned to a graphic then enter "0" to stop alarm messages for any value. See 74-2548 for more details.

The following 8 fields are conditional on almck greater than "0".

almst Engineering unit state for alarm. For example, if a point going OFF is an alarm, then enter "off" into this field.

almpr Alarm Priority (1 to 31). Enter "1" to "31". Alarm priority 1 is the highest priority. High priority alarms display first and replace alarms of lower priority in the alarm area.

almcl Alarm Classification (1 to 4). Enter "1" to "4".
See 74-2548 for more details.

urgent Should point going into alarm cause a dialup? Enter "y" or "n". This field is used for the R7044 dialup configuration.

alm Alarm message number (1 to 9999). Enter "1" to "9999".

lkpnt Lockout point address. Enter point address "cc.bbb.dd.ss.ppp" where cc.bb.dd.ss of the point being alarm locked out MUST be the same as this point. The lockout point is a digital point whose state inhibits alarms from this point (the one being currently programmed in pnt.di)

lkst Lockout state. Enter the digital state that inhibits alarms from this point. (ie. "off" or "on").

lkdly Lockout Delay (1 to 90 minutes). Enter "1" to "90". See 74-2548 for more details.

The following 6 fields are conditional on almck greater than "0" and are conditional on the exact value of almck.
See 74-2548 for more details.

seta Correlated point analog output address.

ha1 High alarm limit 1 (-9999.9 to 99999.9)

ha2 High alarm limit 2 (-9999.9 to 99999.9)

la1 Low alarm limit 1 (-9999.9 to 99999.9)

la2 Low alarm limit 2 (-9999.9 to 99999.9)

dbnd Deadband (0.0 to 9999.99). Typically 0 for CNI OPEN-Link.

cmdh/cmdl Command range (-9999.9 to 99999.9). Enter values "Analog Command Value Range, HIGH for cmdh and LOW for cmdl" from Vendor Documentation for the point and controller type being entered.

rthrs Report threshold (0.01 to 9999.99). Enter "0.01" to "9999.99". This value or Rthrs (from proc record), whichever is less, determines the amount of change that must occur for a new value to be reported or trended (remote trend event).
See 74-2548 for more details.

segid Segregation index number. Enter as appropriate.

des Point descriptor ID number. Enter as appropriate.

pd Point description. Enter as appropriate.

AO - Analog Output Point (pnt.ao - record type)

Each analog output point must have the certain fields programmed in the following manner:

spare Spare record. Enter "n".

use Point use. Enter "misc".

euk Engineering Unit - enter the appropriate CAE EU Key listed Appendix B.

decpl Number of decimal places (0 to 5). Enter a value to display output in vendor specific format. (Decimal place of 0 = XXXXXX. , where 5 = X.XXXXX)

cmdh/cmdl Command range (-9999.9 to 99999.9). Enter values "Analog Command Value Range, HIGH for cmdh and LOW for cmdl" from Vendor Documentation for the point and controller type being entered.

fbk Feedback point address. The analog output point is the setpoint for the floating alarm limits of the analog input point. See 74-2548 for more details.

segid Segregation index number. Enter as appropriate.

des Point descriptor ID number. Enter as appropriate.

pd Point description. Enter as appropriate.

After programming points for all Vendor devices

At this point it should be possible to validate the CAE and generate the database. Remember to make a hard copy (printout) of the subdevice points for the CNI interface R7044 controller. It may be useful when debugging at the site.

7.2 PRODUCT INSTALLATION

Install and check out the Vendor devices per Vendor guidelines before attaching the bus to the CNI.

After installing the R7044 controller and CNI per standard product literature . The special Modbus EPROM OS (S1069) is inserted in the CNI existing EPROM socket (Z207) replacing the standard supplied chip. The database prepared using CAE should be inserted into the R7044 controller. . The datafile in the R7044 controller will be downloaded to the CNI at power-up. The datafile for the Modbus OS prepared using the Modbus configuration tool should be inserted into the CNI board socket(s) (Z211, Z210). The Vendor bus is connected to the RS485 CNI port connections either directly or via a RS232/RS485 converter. See Appendix D for proper RS232 connections

7.3 INSTALLATION CHECKLIST

The following checklist should be followed to insure proper installation and operation of the Honeywell to Vendor interface. Please read all steps first before starting system planning or installation.

1. Make a copy of all EPROMs provided with this product. Install the copied EPROMs in the CNI boards as needed. The master EPROMS should be kept in the job file at the branch. This will facilitate quicker repair of the CNI should the EPROM fail on the CNI board.

2. Review the Vendor device numbers that will be used and verify that no illegal numbers are used.

3. Determine that the R7044 controller to install the CNI board in is of a revision that will accept a CNI board. Refer to the R7044 controller installation guide for this information.

4. Determine if the overall bus is within physical length limits (4000 feet for RS485 using AK3702R cable, 50 feet for RS232 using Belden 9533 cable). The R7044 controller may need to be moved to accommodate these limits.

5. If Honeywell is responsible for the Vendor installation, run the self test and set the network address on each device before attaching it to the Vendor bus.

6. Generate the Modbus database using the Modbus Configuration tool. Generate the CAE for the job using the guidelines listed in section 7.1.

7. Install the CAE generated EPROMs into the R7044 controller and the Modbus Configuration Tool generated EEPROMS in to the CNI board and then verify that the R7044 controller is communicating with the XBSi.

8. Verify that the CNI has the ModBus interface EPROM and not the CNAP standard EPROM on the CNI board.

9. Verify that the Vendor system is operational before it is connected to the CNI board. Verify that polarity is correct (By means of the RS232/RS485 converter, see Appendix D for proper connections.)

10. Verify that the installation drawings for the Vendor devices are consistent for power to each Vendor device.

11. See attached "Literature Requirements" for manuals and documents that may be necessary. The Vendor manuals must be obtained from Vendor. The Honeywell manuals must be obtained from Honeywell Homes and Buildings Control Technical Literature Distribution Center.

12. Bring up the graphics of the Vendor points on the XBSi and verify that the values appear in range.

7.4 STARTUP PROCEDURE

The startup procedure for the OpenLink interface lists the items unique to this interface. It is assumed that the XBSi has been programmed with graphics to correspond to the point datafile as appropriate for the job. In addition, it is assumed that CAE has been generated and that the specific CAE guidelines for the Vendor interfaced have been followed **exactly**. The CAE files produced for the gateway(s) and 7044(s) are installed as the standard product. The OpenLink interface R7044 controller and CNI are started up as follows :

1. With power turned off, install the generated CAE EPROMS for the R7044 controller as described in the 7044 literature for an R7044 controller with a CNI to MicroCels.

2. After installing the CNI board per standard literature insert the OpenLink ModBus EPROM on the CNI board in socket Z207. Add any additional RAM needed on the CNI in socket Z209. Install the Modbus Configuration tool generated EEPROM database in Z211 and if required also into Z210.

3. Verify that the Vendor system is operational.

4. Attach the Vendor bus. For RS485 use (CNAP + and CNAP -) on the right hand side of the CNI board. For RS232 connections see Appendix D.

5. Power up the R7044 controller. Within a minute the CNI will receive its point datafile and should begin scanning. The LED digit, on the 7-segment LED, should "circle" and the red send and receive leds should be flashing.

6. Verify that the point values are being displayed at the XBSi for the Vendor subsystem.

7. Refer to the DIAGNOSTIC & TROUBLESHOOTING section if problems are encountered.

8. The system should be operational now!

7.5 DIAGNOSTIC & TROUBLESHOOTING

Condition where no values are received from the Vendor at the Central PC

1. Verify that the Vendor system is operational. See attached "Literature Requirements" for manuals and documents that may be necessary. The Vendor manuals must be obtained from Vendor. The Honeywell manuals must be obtained from Honeywell Homes and Buildings Control Technical Literature Distribution Center.

2. Verify that the R7044 controller AC Power is Operational. This is easily accomplished by observing if any of the panel lights are on, and if the middle LED of the 3 green LEDs is flashing (indicates scan). In all cases be sure to conform to the applicable local electrical codes.

3. Verify that the Excel Building Supervisor - integrated (XBSi) and R7044 controller containing the CNI board are operational. This may be easily done if some "real" point off the R7044 controller can be displayed on the XBSi. If a standard R7044 controller point will not display on the XBSi refer to "Literature Requirements" for manuals containing more detail on how to make these operational.

4. Verify that the CNI board is scanning its datafile. This is done by observing if the red 7-Segment digit is rotating in a clockwise pattern. If it is, it means that CNI has received a datafile and is scanning it. If the digit displays a value refer to the error diagnostic section and correct the problem.

5. Verify that the CNI board is scanning the Vendor devices. This is done by observing if the red send and receive leds are blinking on the bottom of the CNI board. If both leds are blinking it means that responses are being received by the CNI from the Vendor system. If both lights are not blinking it could indicate that the RS485 bus wires are not connected properly, or the polarity of the wires is incorrect. If only the red XMIT LED (leftmost LED of the pair) is blinking than the RS485 bus or the Vendor equipment is not properly connected. Check for proper address setting on the Vendor devices. Check that bus signal is getting to the devices.

6. If the CNI can receive a response from the Vendor system but generates "NO RESPONSE" at the XBSi. The problem is likely to be that the R7044 controller or subdevice addressing is in error.

7. Once a device is marked as Not Responding by the CNI, it will not attempt to communicate with that device for up to 3-5 minutes.

8. Verify that the baud rate selected in the Modbus Configuration tool is the same as the baud rate selected on the dip switches on the CNI board (refer to appendix C).

Condition where some Vendor points respond

1. If some of the Vendor point values displayed at the XBSi give abnormal readings or generate a "NO RESPONSE", verify that the CAE listing for these points matches the addressing selected for the Vendor devices and that the point addressing for the XBSi graphics is correct.

2. If some of the Vendor point values displayed at the XBSi give abnormal readings, verify that the CAE listing for these points matches the types and is in proper point order in the appendices at the end of this document.

3. If some Vendor points still do not give valid values - verify that the XBSi has the proper point class assigned for each point.

3. If some Vendor points still do not give valid values - verify that the Vendor point numbers used are valid in the vendor device image being used.

8. TECHNICAL TRAINING REQUIREMENTS

No special training is expected to be necessary for this product. It is expected that the technician installing or programming this job is trained in CAE and R7044 controllers . If training is deemed necessary for installation and checkout of the Vendor devices then the branch may need to make arrangements to receive training from Vendor.

The branch is expected to contact Vendor directly when dealing with the Vendor portion of the installation unless the issue is related to the Honeywell interface or the ability of that interface to read or command Vendor device points.

9. REGULATORY AGENCY CERTIFICATION

The changes made in the software will not void FCC class A on the R7044 controller panel.

10. APPENDIX A - EXAMPLE DEVICE POINT DEFINITION

Overview

ABB's standard ACH 500 drives can now interface directly with the OpenLink controller. This can be done with no additional drive hardware by using the ABB's standard ACH 500 built-in serial modbus interface. Integration to Honeywell system is therefore easy. To use these drives with the EXCEL 5000 XBSi system, the drives need to be wired properly, and the drive configuration parameters need to be setup for the application. The drive configuration is done through the drive panel, and is typically done by ABB approved start-up personnel.

Installation

Detailed drive installation instructions are in the ACH500 Installation & Start-up Manual (ACH501-04 and ACH502-04) and in the ACS500 Modbus Protocol Installation & Start-up Manual (ACS500-MODBUS-US-04). Detailed drive programming instructions are in the ACH500 Programming manual (ACH500-05).

Drive configuration for feedback

Only the drive communication setup parameters need to be programmed for the OpenLink controller to read actual values and status information from the ACH 500 drive. These parameters are:

ACH 500 Setup for Monitoring

Parameter	Parameter Name	Description
10.8.1	DRIVE ID-NUMBER	The drive node number on Modbus network. This number identifies the drive.
10.8.2	PROTOCOL	Must be set to MODBUS. GS-Bus option is for ABB drive remote panel only.
10.8.3	BIT RATE SELECT	Must match the selection on the OpenLink controller. Selections available are: 9600/4800 Baud
10.8.4	PARITY	Must match the selection on the OpenLink controller. Selections available are: NONE/EVEN/ODD

Note: If there is a change to any of these parameters, the power to the drive must be cycled down before these changes will take effect.

Drive Configuration for control

The drive control source is configurable from the local drive panel. This configuration will affect how the drive starts, stops, and receives it running reference. The sources for these actions can be digital inputs, analog inputs, keypad, or serial modbus communication network. If the drive is to be controlled through the OpenLink controller, these parameters need to be set up for communication. On the following table, if you need to control a point (like Reference 1) set the corresponding parameter value to STD COMM.

ACH 500 Setup for Control

Control Point	Parameter	Parameter Name	Description
Reference 1	10.2.2	EXTERNAL REF1 SEL	Select the source for the frequency reference.
Reference 2	10.2.7	EXTERNAL REF2 SEL	Select the source for the process reference.
Current Limit			No setup necessary
Accel Time 1			No setup necessary
Decel Time 1			No setup necessary
PI-Cont Gain			No setup necessary
PI-Cont I-Time			No setup necessary
Fault Reset	10.4.2	FAULT RESET SELECT	Select the source for clearing a drive fault.
Stop/Start	10.1.1 10.1.2	EXT 1 STRT/STP/DIR EXT 2 STRT/STP/DIR	Select the source for drive start and stop control. The setup parameter depends on the selected reference. For Reference 1 set the 10.1.1, and for Reference 2 set the 10.1.2.
	10.1.3 10.1.1 10.1.2	LOC/EXT DIRECTION EXT 1 STRT/STP/DIR EXT 2 STRT/STP/DIR	Select the allowed direction. Set the 10.1.3 to REQUEST for remote contorl. Also set the correct control location as for the point P27.
Panel Lock	10.4.3	PARAM. LOCK SEL	Select the source for disabling the parameter changes from the local drive panel.
Ref 1/Ref 2	10.2.1	EXT 1/EXT 2 SELECT	Select the source for selecting which drive reference is active.

Note: There is no need to cycle the power to the drive after changing these parameters.

Description of ACH 500 Data Points

The following table describes all the data points which can be accessed from the ACH 500 drive through the OpenLink controller.

ACH 500 OpenLink Datapoint Description

Point	Description
Output Frequency	Drive actual output frequency.
Speed	Drive actual output speed in RPM.
Current	Drive actual output current in Amps.
Torque Actual	Actual calculated motor torque.
Power Actual	Actual calculated output power.
Drive Temp	Actual drive heatsink temperature.
Energry Wh Energy kWh Energy MWh	Cumulative drive output energy. This is given out in three registers. This can be used to calculate the differential energy consumption. To get the total energy add these registers together like: Energy = 1,000,000*P9 + 1,000*P8 + P7.
Last Fault Second Fault First Fault	Value of the drive fault queue entries. Zero is no fault, other values indicate a warning or a fault in the queue. Fault codes are described in the ACS500-MODBUS manual.
PI-Ctrl Actual	Shows the actual feedback value in % while using the drive built-in PI-Controller.
Reference 1	Drive frequency reference for reference 1.
Reference 2	Drive percentage reference for reference 2, PI setpoint for PI Control.
Current Limit	Drive current limit in percentage of nominal.
Accel Time 1	Drive acceleration time from 0 to max speed.
Decel Time 1	Drive deceleration time from max speed to 0.
PI-Cont Gain	Gain setup for the drive built-in PI-Controller.
PI-Cont I-Time	Integration time setup for the drive built-in PI-Controller.
Relay Output 1 Relay Output 2 Relay Output 3	Value of the drive relay outputs. These can be used for a customer configured drive status outputs by programming the relay outputs with parameters 10.6.1 - 10.6.3. The relay output values are readable, even if the relays are not wired anywhere.
OK/Fault	Drive status, OK or Faulted.
Stop/Run	Drive status, Running or stopped.
Fault Reset	Used to remotely clear a drive fault.
Stop/Start	Start and stop the drive.
Forward/Reverse	Remote control of the drive running direction.
Panel Lock	Used for remotely lock the drive local panel to read-only mode.
Ref 1/Ref 2	Used for remotely select the drive reference mode.

Sample Vendor Device point information for ABB ACH500 drives.

(The following data is input into the Modbus Configuration tool to create the group template except R7044 low, high and units)

Template Point Number	ABB ACH500 Point Description	Modbus Reg. Type	HPEP Point Type	Modbus Data Type	HPEP Data Type	Modbus Address	Modbus File ID	Modbus Ana bit position	Modbus Scale	Modbus Offset	R7044 Low Value	R7044 High Value	R7044 Units
1	RESERVED-not used												
2	OutputFrequency	HLDR	ANA+RO	16_ANA	2BU	1	0	0	0.01	0.0	0.00	120.00	hz
3	Speed	HLDR	ANA+RO	16_ANA	2BU	2	0	0	1.0	0.0	0	65535	rpm
4	Current	HLDR	ANA+RO	16_ANA	2BU	3	0	0	0.1	0.0	0.0	6553.5	amp
5	TorqueActual	HLDR	ANA+RO	16_ANA	2BS	4	0	0	1.0	0.0	-300	300	pct
6	PowerActual	HLDR	ANA+RO	16_ANA	2BS	5	0	0	1.0	0.0	-300	300	pct
7	DriveTemperature	HLDR	ANA+RO	16_ANA	2BS	8	0	0	1.0	0.0	-10	100	deg
8	Reference1	HLDR	ANA+RW	16_ANA	2BU	13	0	0	0.01	0.0	0.00	120.00	hz
9	Reference2	HLDR	ANA+RW	16_ANA	2BU	14	0	0	0.01	0.0	0.00	100.00	pct
10	LastFault	HLDR	ANA+RO	16_ANA	2BU	17	0	0	1.0	0.0	0	65535	ind
11	SecondFault	HLDR	ANA+RO	16_ANA	2BU	18	0	0	1.0	0.0	0	65535	ind
12	FirstFault	HLDR	ANA+RO	16_ANA	2BU	19	0	0	1.0	0.0	0	65535	ind
13	P1-ControlActual	HLDR	ANA+RO	16_ANA	2BS	21	0	0	0.1	0.0	-300	300	pct
14	CurrentLimit	HLDR	ANA+RW	16_ANA	2BU	2104	0	0	1.0	0.0	50	200	pct
15	Accel.Time1	HLDR	ANA+RW	16_ANA	2BU	2303	0	0	0.1	0.0	0.1	1800.0	sec
16	Decel.Time1	HLDR	ANA+RW	16_ANA	2BU	2304	0	0	0.1	0.0	0.1	1800.0	sec
17	P1-ContGain	HLDR	ANA+RW	16_ANA	2BU	4101	0	0	0.1	0.0	3.0	800.0	pct
18	P1-Cont1-Time	HLDR	ANA+RW	16_ANA	2BU	4102	0	0	0.01	0.0	0.02	320.00	sec
19	Stop/Run	HLDR	DIG+RO	BIT_ANA	DIG	5101	0	1	---	---	0=Stop	1=Run	fon
20	OK/Fault	HLDR	DIG+RO	BIT_ANA	DIG	5101	0	3	---	---	0=OK	1=Fault	fon
21	Stop/Start	HLDR	DIG+RW	BIT_ANA	DIG	5102	0	5	---	---	0=Stop	1=Start	fon
22	Ref1/Ref2	HLDR	DIG+RW	BIT_ANA	DIG	5102	0	6	---	---	0=Ref 1	1=Ref 2	fon
23	PanelLock	HLDR	DIG+RW	BIT_ANA	DIG	5102	0	14	---	---	0=Not	1=Locked	fon
24	FaultReset	HLDR	DIG+RW	BIT_ANA	DIG	5102	0	15	---	---	0->1	Resets	fon
25	Forward/Reverse	HLDR	DIG+RW	BIT_ANA	DIG	5102	0	16	---	---	0=Fwd	1=Rev	fon
26	Energy(Wh)	HLDR	ANA+RO	16_ANA	2BU	5104	0	0	1.0	0.0	0	999	wh
27	Energy(KWh)	HLDR	ANA+RO	16_ANA	2BU	5105	0	0	1.0	0.0	0	999	kwh
28	Energy(MWh)	HLDR	ANA+RO	16_ANA	2BU	5106	0	0	1.0	0.0	0	65535	mwh
29	RelayOutput1	HLDR	DIG+RO	BIT_ANA	DIG	5110	0	1	---	---	0=Off	1=On	fon
30	RelayOutput2	HLDR	DIG+RO	BIT_ANA	DIG	5110	0	2	---	---	0=Off	1=On	fon
31	RelayOutput3	HLDR	DIG+RO	BIT_ANA	DIG	5110	0	3	---	---	0=Off	1=On	fon

The following Report is generated by the Modbus Configuration Tool:

ABB Test Project ABB.SRC

Sch Delay: 10 Comm Mode : RTU Baud Rate: 9600
Parity : Even Coil Write: Single Reg Write: Single

SS-ModBus: 1-247
SS-ModBus: 2-246
==========

Group Template: 1 Num Points : 31
Resp Time : 1000 Max Coil : 8 Max Inp Sts : 8
Max Hld Reg: 8 Max Inp Reg: 8 Max Extm Reg: 1

PT Type Cnapnt Cnapnode Desc
RegTyp HpTyp MbDTyp HpDTyp MbAddr ExF Pos Scale Offset
---

1 AI 1 SS+50 Template Select Point

2 AI 31 SS+50 Output Frequency
Hldr ana-ro 16-ana 2bu 1 0 0 0.010 0.000

3 AI 32 SS+50 Speed
Hldr ana-ro 16-ana 2bu 2 0 0 1.000 0.000

4 AI 33 SS+50 Current
Hldr ana-ro 16-ana 2bu 3 0 0 0.100 0.000

5 AI 34 SS+50 Troque Actual
Hldr ana-ro 16-ana 2bs 4 0 0 1.000 0.000

6 AI 35 SS+50 Power Actual
Hldr ana-ro 16-ana 2bs 5 0 0 1.000 0.000

7 AI 36 SS+50 Drive Temperature
Hldr ana-ro 16-ana 2bs 8 0 0 1.000 0.000

8 AO 37 SS+50 Reference 1
Hldr ana-rw 16-ana 2bu 13 0 0 0.010 0.000

9 AO 38 SS+50 Reference 2
Hldr ana-rw 16-ana 2bu 14 0 0 0.010 0.000

10 AI 39 SS+50 Last Fault
Hldr ana-ro 16-ana 2bu 17 0 0 1.000 0.000

11 AI 40 SS+50 Second Fault
Hldr ana-ro 16-ana 2bu 18 0 0 1.000 0.000

12 AI 41 SS+50 First Fault
Hldr ana-ro 16-ana 2bu 19 0 0 1.000 0.000

13 AI 42 SS+50 P1 Control Actual
Hldr ana-ro 16-ana 2bs 21 0 0 0.100 0.000

```
14  AO    43    SS+50          Current Limit
    Hldr  ana-rw  16-ana  2bu    2104   0  0    1.000    0.000

15  AO    47    SS+50          Accel Time
    Hldr  ana-rw  16-ana  2bu    2303   0  0    0.100    0.000

16  AO    48    SS+50          Decel Time1
    Hldr  ana-rw  16-ana  2bu    2304   0  0    0.100    0.000

17  AO    49    SS+50          P1 Cont Gain
    Hldr  ana-rw  16-ana  2bu    4101   0  0    0.100    0.000

18  AO    50    SS+50          P1 Cont1 Time
    Hldr  ana-rw  16-ana  2bu    4102   0  0    0.010    0.000

19  DI    51    SS+50          Stop / Run
    Hldr  dig-ro  bit-ana dig    5101   0  1    0.000    0.000

20  DI    52    SS+50          OK / Fault
    Hldr  dig-ro  bit-ana dig    5101   0  3    0.000    0.000

21  DO    53    SS+50          Stop / Start
    Hldr  dig-rw  bit-ana dig    5102   0  5    0.000    0.000

22  DO    54    SS+50          Ref1 / Ref2
    Hldr  dig-rw  bit-ana dig    5102   0  6    0.000    0.000

23  DO    55    SS+50          Panel Lock
    Hldr  dig-rw  bit-ana dig    5102   0  14   0.000    0.000

24  DO    56    SS+50          Fault Reset
    Hldr  dig-rw  bit-ana dig    5102   0  15   0.000    0.000

25  DO    57    SS+50          Forward / Reverse
    Hldr  dig-rw  bit-ana dig    5102   0  16   0.000    0.000

26  AI    58    SS+50          Energy (Wh)
    Hldr  ana-ro  16-ana  2bu    5104   0  0    1.000    0.000

27  AI    59    SS+50          Energy (KWh)
    Hldr  ana-ro  16-ana  2bu    5105   0  0    1.000    0.000

28  AI    60    SS+50          Energy (MWh)
    Hldr  ana-ro  16-ana  2bu    5106   0  0    1.000    0.000

29  DI    61    SS+50          Relay  Output 1
    Hldr  dig-ro  bit-ana dig    5110   0  1    0.000    0.000

30  DI    62    SS+50          Relay Output 2
    Hldr  dig-ro  bit-ana dig    5110   0  2    0.000    0.000

31  DI    63    SS+50          Relay Output 3
    Hldr  dig-ro  bit-ana dig    5110   0  3    0.000    0.000
```

Note: The R7044 Point Number PPP must match the PT number (first column) in the Modbus Configuration Tool Report.

11. APPENDIX B - R7044 Engineering Units

This section describes the available analog and digital engineering units that may be used.

ANALOG:

CAE EU Key	Text	Description
		Temperature
Deg	deg	Fahrenheit temperature or angular measurement
k	K	Kelvin
di	DD	Degree-days (F or C)
wbt	WBT	Wet-bulb temperature
dpt	DPT	Dew-point temperature
cel	CEL	Celsius
		Pressure
psi	PSI	Pounds per square inch
inw	INW	Inches water column
ftw	FTW	Feet water column
inm	INM	Inches mercury column
pa	Pa	Pascal
kpa	kPa	Kilopascal
bar	BAR	Bar (14.5 psi)
mbr	mBR	Millibar
mmm	mmM	Millimeters mercury
mwa	mW	Meters water
cmw	cmW	Centimeters water
mmw	mmW	Millimeters water
		Energy
btu	BTU	British thermal units
kb	kB	BTU x 1,000
mb	MB	BTU x 1,000,000
thm	THM	Therm
thr	THR	Ton-hour
bpp	BPP	BTU per pound
bpg	BPG	BTU per gallon
hur	HUR	Humidity ratio (pounds of moisture per pound of dry air)
cal	CAL	Calories
kcl	kCL	Kilocalories
mcl	MCL	Megacalories
j	J	Joules
kj	kJ	Kilojoules
mj	MJ	Megajoules
gj	GJ	Gigajoules
jpk	JPK	Joules per kilogram
kjk	kjk	Kilojoules per kilogram

		Mass
lbs	LBS	Pounds
ton	TON	Tons
kg	kg	Kilograms
tne	TNE	Tonnes (metric tons)
		Energy Transfer
bph	BPH	BTU per hour
kbh	kBH	Kilo BTU per hour
mbh	MBH	Mega BTU per hour
ton	TON	Tons (refigeration rate and mass)
jps	JPS	Joules per second
kjm	kJM	Kilojoules per minute
kjh	kJH	Kilojoules per hour
mjh	MJH	Megajoules per hour
gjh	GJH	Gigajoules per hour
		Light
fc	FC	Footcandles
lux	LUX	Lux
wsf	WSF	Watts per square foot
wsm	WSM	Watts per square meter
		Mass Flow
lbh	LBH	Pounds per hour
lbm	LBM	Pounds per minute
klh	kLH	Kilopounds per hour
mlh	MLH	Megapounds per hour
tnh	TNH	Tons per hour
kgs	kgS	Kilograms per second
kgm	kgM	Kilograms per minute
kgh	kgH	Kilograms per hour
		Volumetric Flow
cfm	CFM	Cubic feet per minute
gpm	GPM	Galons per minute
cms	CMS	Cubic meters per second
cmm	CMM	Cubic meters per minute
cmh	CMH	Cubic meters per hour
lps	LPS	Liters per second
lpm	LPM	Liters per minute
lph	LPH	Liters per hour
		Volume
cf	CF	Cubic feet
gal	GAL	Gallons
cm	CM	Cubic meters
l	L	Liters
		Velocity
fpm	FPM	Feet per minute
fps	FPS	Feet per second
mph	MPH	Miles per hour
mps	MPS	Meters per second
kmh	kMH	Kilometers per minute
mpm	MPM	Meters per minute

Mechanical Power		
hp	HP	Horsepower
Area		
sqf	SQF	Square feet
sqm	SQM	Square meters
Electricity		
w	W	Watts
kw	kW	Kilowatts
mw	MW	Megawatts
amp	A	Amperes
ma	mA	Milliamperes
ka	kA	Kiloamperes
v	V	Volts
kv	kV	Kilovolts
va	VA	Volt-amperes
kva	kVA	Kilovolt-amperes
mva	MVA	Megavolt-amperes
var	VAR	Volt-amperes reactive
kvr	kVR	Kilovolt-amperes reactive
mvr	MVR	Megavolt-amperes reactive
wh	WH	Watt-hours
kwh	kWH	Kilowatt-hours
mwh	MWH	Megawatt-hours
Time		
yr	YR	Year
mo	MO	Month
wk	WK	Week
day	DAY	Day
hr	HR	Hour
min	MIN	Minute
sec	SEC	Second
ms	mS	Millisecond
Miscellaneous		
mm	mm	Millimeters
pct	PCT	Percent
rh	RH	Relative humidity
ppm	PPM	Parts per million
ppb	PPB	Parts per billion
ph	Ph	Acidity
hz	Hz	Hertz
rpm	RPM	Revolutions per minute
rat	RAT	Ratio
cop	COP	Coefficient of Performance
dwh	DWH	Degree of water hardness
mks	MKS	Microsiemans
cos	COS	Power Factor
gkg	gkg	Grams of water per kilogram of dry air

General		
bnk	---	Blanks, No test appears
ana	ANA	Analog
tot	TOT	Total
val	VAL	Value
id	ID	Identifier
ind	IND	Index
gen	GEN	General
pos	POS	Position
cnt	CNT	Counts

DIGITAL:

CAE EU Key	State 0	State 1	State 2	State 3	Description
fon	off	on	---	---	Off / On
opc	opn	clo	---	---	Open / Closed
nid	nit	day	---	---	Night / Day
sca	sec	acc	---	---	Secure / Access
acs	acc	sec	---	---	Access / Secure
wns	win	sum	---	---	Winter / Summer
lcr	loc	rem	---	---	Local / Remote
htc	htg	clg	---	---	Heating / Cooling
rvf	rev	for	---	---	Reverse / Foward
ff	fn	fa	---	---	Fan Normal / Fan Allarm
fz	fzn	fza	---	---	Freeze Normal / Freeze Alarm
na	nml	alm	---	---	Normal / Alarm
acs	acc	sec	---	---	Access / Secure
sca	sec	acc	---	---	Secure / Access
aus	AUD	SIL	---	---	Audible / Silence
sia	SIL	AUD	---	---	Silence / Audible
din	DIS	EN	---	---	Disable / Enable
end	EN	DIS	---	---	Enable / Disable
fmn	off	mom	---	---	Off / Momentary On
hnf	HON	HOF	---	---	Hook On / Hook Off
ret	RST	TST	---	---	Reset / Test
ter	TST	RST	---	---	Test / Reset

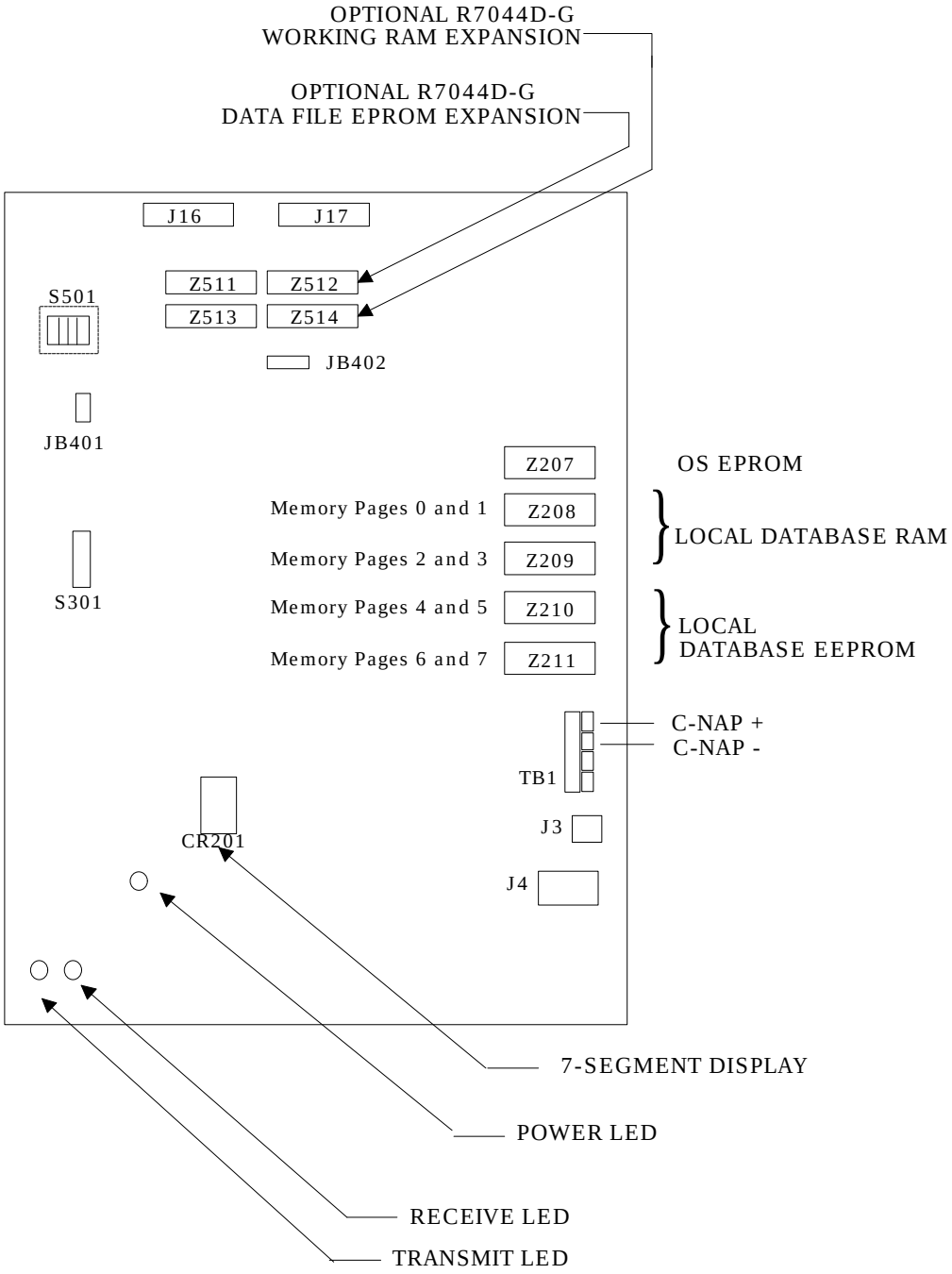
The OpenLink converts the value of the point to correct State number:

OpenLink only supports State 0 and State 1 digital points.

State 0 = vendor point value of 0

State 1 = vendor point value of 1

12. APPENDIX C - CNI BOARD DIAGRAM



Memory Density Selections: S501 Switch -- CNI Board

R7044 controller Parom Req'd	R7044 controller Param Req'd	R7044 controller Z205 & Z206	CNI Z511 & Z512	CNI Z513 & Z514	CNI S501 OFF=0 ON = 1
0-64 kb	0-64 kb	32 kb each	----------	----------	0 0 0 0
64-128 kb	64-128 kb	64 kb each	----------	32 kb each	0 0 0 0
128-256 kb	128-256 kb	64 kb each	64 kb each	128 kb each	0 1 0 0
256-320 kb	256-320 kb	64 kb each	128 kb each	128 kb each	0 1 0 1
320-512 kb	320-512 kb	128 kb each	128 kb each	128 kb each	1 1 1 1

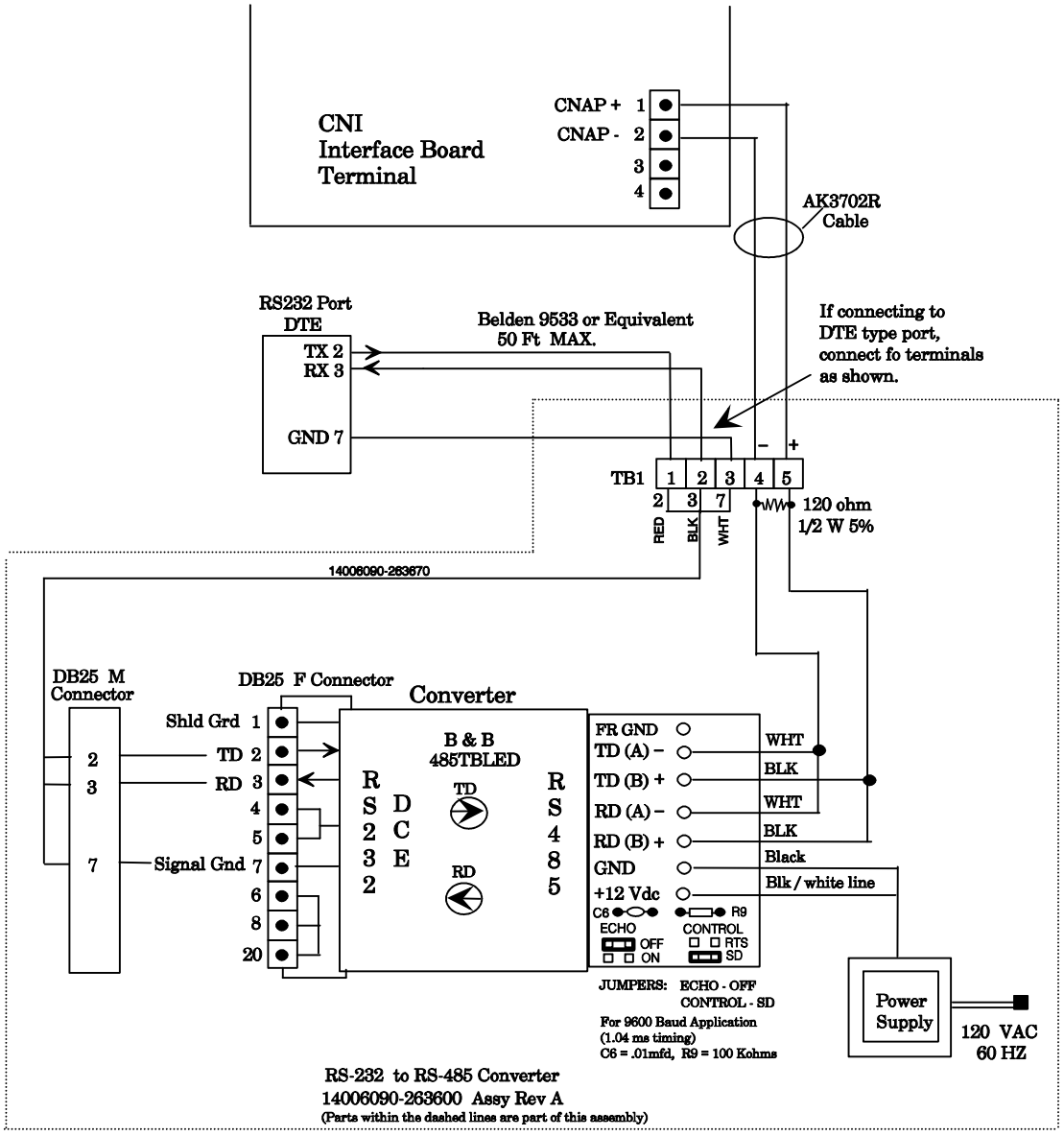
System Configure Settings: S301 Switch -- CNI Board

s301-1	off	ON - selects 19200 bps clock for RS485 port
s301-2	off	ON - selects 9600 bps clock for RS485 port
s301-3	off	ON - selects 4800 bps clock for RS485 port
s301-4	off	
s301-5	off	
s301-6	on	enables upper 750 ohm bus biasing resistor (optional)
s301-7	on	enables lower 750 ohm bus biasing resister (optional)
s301-8	on	enables 120 ohm EOLR (optional)
s301-9	off	
s301-10	on	use R7044 controller D/E/F serial clock for RS485 port (required)

Note: Select s301-1 OR s301-2 OR s301-3 for the proper baud rate for your application.

Note: The s301-6 through s301-8 switch settings are site specific. Use these instead of adding bias and termination resistors (R1,R2 and R3) shown on following page

13. APPENDIX D - RS232/RS485 Wiring Diagram



14. APPENDIX E - Power Measurement Ltd - 3300 ACM

The 3300 ACM device can be interfaced to the DeltaNet system via the CNI board through a Modbus interface. This Modbus device is mentioned here only because it has some unique methods of utilizing the Modbus standards.

Some of these unique methods are:

1. Signed values require a register read for the value and another register read for the sign.
2. Power Measurements uses a 16 bit register size or a 32 bit register size.
3. A system password is required to reset hours (Modbus addr. 3012) and min / max. register (Modbus addr. 3011) values. **PLEASE NOTE THAT THESE TWO POINTS, 3011 and 3012, ARE THE ONLY COMMANDABLE POINTS IN THIS INTERFACE.**

Items 1 & 2 are handled in the Modbus OpenLink Configuration Tool. The details are described in the Modbus OpenLink Configuration Tool User's Guide Appendix C.

Item 3 is handled in this interface package by modifying the CNI Modbus EPROM. If a customer wants the ability to reset 3300 ACM hour and Min / Max values, the password must be placed in the CNI Modbus EPROM at location 0x8002 and 0x8003.

The 3300 ACM default password is 0 and default values in locations 0x8002 & 0x8003 = 0x0000.

Example: The 3300 ACM password is 15
0x8002 = 00
0x8003 = 0F

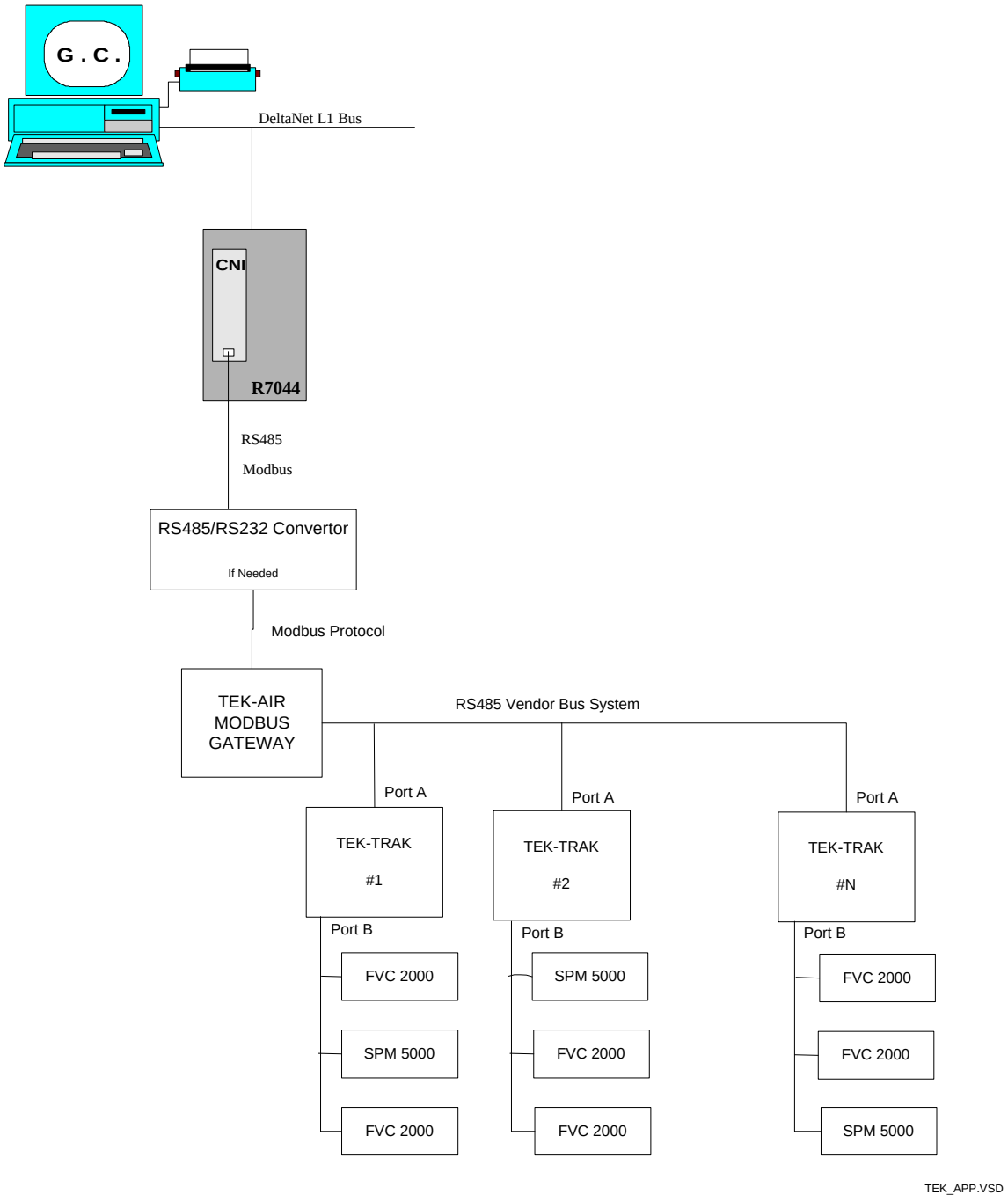
Example: The 3300 ACM password is 9
0x8002 = 00
0x8003 = 09

Note: The 3300 ACM devices have RS485 ports. No RS232 to RS485 converter is needed.

15. APPENDIX F - Tek-Air Modbus Gateway

The OpenLink Modbus Interface may be used to monitor and control Tek-Air devices through the use of the Tek-Air Modbus Gateway. This appendix will discuss the method to map OpenLink points to Modbus points so that they may be used by the Tek-Air Modbus Gateway.

The following figure shows a typical Modbus Tek-Air System Configuration.



Use the following table when mapping points using the Modbus Configuration Tool. The report output from the Modbus Configuration Tool will be used when CAEing the points for the OpenLink R7044.

TEK-TRAK MODBUS CONTROLLER POINT LIST

Description of point	Modbus point number	Modbus Configuration Point Type
Analog Output 1	161	Holding Register
Analog Output 2	162	Holding Register
Analog Output 3	163	Holding Register
Analog Output 4	164	Holding Register
Analog Output 5	165	Holding Register
Analog Output 6	166	Holding Register
Analog Output 7	167	Holding Register
Analog Output 8	168	Holding Register
Analog Output 9	169	Holding Register
Analog Output 10	170	Holding Register
Analog Output 11	171	Holding Register
Analog Output 12	172	Holding Register
Analog Output 13	173	Holding Register
Analog Output 14	174	Holding Register
Analog Output 15	175	Holding Register
Analog Output 16	176	Holding Register
Analog Input 1	193	Input Register
Analog Input 2	194	Input Register
Analog Input 3	195	Input Register
Analog Input 4	196	Input Register
Analog Input 5	197	Input Register
Analog Input 6	198	Input Register
Analog Input 7	199	Input Register
Analog Input 8	200	Input Register
Analog Input 9	201	Input Register
Analog Input 10	202	Input Register
Analog Input 11	203	Input Register
Analog Input 12	204	Input Register
Analog Input 13	205	Input Register
Analog Input 14	206	Input Register
Analog Input 15	207	Input Register
Analog Input 16	208	Input Register
Digital Input 1	209	Input Status
Digital Input 2	210	Input Status

Digital Input 3	211	Input Status
Digital Input 4	212	Input Status
Digital Input 5	213	Input Status
Digital Input 6	214	Input Status
Digital Input 7	215	Input Status
Digital Input 8	216	Input Status
Digital Input 9	217	Input Status
Digital Input 10	218	Input Status
Digital Input 11	219	Input Status
Digital Input 12	220	Input Status
Digital Input 13	221	Input Status
Digital Input 14	222	Input Status
Digital Input 15	223	Input Status
Digital Input 16	224	Input Status
Digital Output 1	177	Coil
Digital Output 2	178	Coil
Digital Output 3	179	Coil
Digital Output 4	180	Coil
Digital Output 5	181	Coil
Digital Output 6	182	Coil
Digital Output 7	183	Coil
Digital Output 8	184	Coil
Digital Output 9	185	Coil
Digital Output 10	186	Coil
Digital Output 11	187	Coil
Digital Output 12	188	Coil
Digital Output 13	189	Coil
Digital Output 14	190	Coil
Digital Output 15	191	Coil
Digital Output 16	192	Coil
A0 - Variable Parameter	1	*
B0	2	*
C0	3	*
D0	4	*
E0	5	*
F0	6	*
G0	7	*
H0	8	*
I0	9	*
J0	10	*
K0	11	*
L0	12	*
M0	13	*
N0	14	*

O0	15	*
P0	16	*
Q0	17	*
R0	18	*
S0	19	*
T0	20	*
U0	21	*
V0	22	*
W0	23	*
X0	24	*
Y0	25	*
Z0	26	*
A1 - Variable Parameter	27	*
B1	28	*
C1	29	*
D1	30	*
E1	31	*
F1	32	*
G1	33	*
H1	34	*
I1	35	*
J1	36	*
K1	37	*
L1	38	*
M1	39	*
N1	40	*
O1	41	*
P1	42	*
Q1	43	*
R1	44	*
S1	45	*
T1	46	*
U1	47	*
V1	48	*
W1	49	*
X1	50	*
Y1	51	*
Z1	52	*
A2 - Variable Parameter	53	*
B2	54	*
C2	55	*
D2	56	*
E2	57	*
F2	58	*

G2	59	*
H2	60	*
I2	61	*
J2	62	*
K2	63	*
L2	64	*
M2	65	*
N2	66	*
O2	67	*
P2	68	*
Q2	69	*
R2	70	*
S2	71	*
T2	72	*
U2	73	*
V2	74	*
W2	75	*
X2	76	*
Y2	77	*
Z2	78	*
A3 - Variable Parameter	79	*
B3	80	*
C3	81	*
D3	82	*
E3	83	*
F3	84	*
G3	85	*
H3	86	*
I3	87	*
J3	88	*
K3	89	*
L3	90	*
M3	91	*
N3	92	*
O3	93	*
P3	94	*
Q3	95	*
R3	96	*
S3	97	*
T3	98	*
U3	99	*
V3	100	*
W3	101	*
X3	102	*

Y3	103	*
Z3	104	*
A4 - Variable Parameter	105	*
B4	106	*
C4	107	*
D4	108	*
E4	109	*
F4	110	*
G4	111	*
H4	112	*
I4	113	*
J4	114	*
K4	115	*
L4	116	*
M4	117	*
N4	118	*
O4	119	*
P4	120	*
Q4	121	*
R4	122	*
S4	123	*
T4	124	*
U4	125	*
V4	126	*
W4	127	*
X4	128	*
Y4	129	*
Z4	130	*
A5 - Variable Parameter	131	*
B5	132	*
C5	133	*
D5	134	*
E5	135	*
F5	136	*
G5	137	*
H5	138	*
I5	139	*
J5	140	*
K5	141	*
L5	142	*
M5	143	*
N5	144	*
O5	145	*
P5	146	*

Q5	147	*
R5	148	*
S5	149	*
T5	150	*
U5	151	*
V5	152	*
W5	153	*
X5	154	*
Y5	155	*
Z5	156	*

* Modbus Configuration Point Type is variable by point. This point type will be given by Tek-Air and will be used by the Modbus Configuration Tool supplied with the OpenLink system.

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74-3394 Feb 2000