

SPECIFICATION

ACW_n SLAVE MODBUS INTERFACE TEMPLATE ACWN v 2.2 on.

Modification Record

Draft: Derived from 7-6084-04 and OPC interface restrictions. H R Lane 20/04/04
Issue 1: Modified for ACWn version 2.2 and Modbus Mapper 1.01. H R Lane 30/04/04
Issue 2: Modified for Measured Value floating point definition. H R Lane 27/09/04
Issue 3: Modified for P200/5000/ACU – Derived channels > 8. H R Lane 24/12/04
Issue 4: IOU DC Channels and Digital Inputs added. H R Lane 13/09/05
Issue 5: Do AutoCal Now added. H R Lane 26/06/06

General Description

The Modbus Slave Interface is provided by an OPC Client program – Modbus Mapper – for ACWn.
See the Modbus Mapper Operation Manual for Install, Configuration and Set-up details.
This document describes the format to be used as standard issue of Procal factory configured interfaces.

Version 7-6081-01 – issue 05 26/06/06.

Data Types Available

Measured Channels

These are the live readings, as available for selection on the ACW Panel screen

P200 and P5000

8 Measured Component Channels per head (7, 8 used by P5000)

8 DC Channels per head (usually 3 internal and 5 external for P5000, 3 external for P200)

8 Derived Channels per head (additional Derived Channels configurable).

IOU

32 DC Channels.

16 Digital Channels.

Status Data

Head Data – Head Address
Instrument Enabled
Head Serial Number

Operational - Real Time Clock
AutoZero Phase
Manual Cal Gas Flags
Solenoid Status Flags.

Alarms

P200/P5000

Channels – Status of each of the 8 Alarm types for each of the first 24 channels per head.

Head - Status of each of the 8 types of head alarm, per head.

IOU

Channels – Status of the 5 Alarm types for each channel.

Head – Status of each of the 3 valid alarm types.

Control

Remote control of the following functions per head.

Auto Zero Now.
AutoCal Now
Zero Air Solenoid
Auto Cal Gas Solenoid 1.
Auto Cal Gas Solenoid 2.
Auto Cal Gas Solenoid 3.

Data Locations

Modbus Registers

Types

Modbus has 4 useable Memory Types:

0	-	Discrete Coils	:	10000 addressable bits	:	Read/Write
1	-	Discrete Inputs	:	10000 addressable bits	:	Read Only
2	-	Not Used				
3	-	Input Registers	:	10000 addressable words	:	Read Only
4	-	Holding Registers	:	10000 addressable words	:	Read/Write

The structure is designed to allow mapping of one head into one slave address. We have available 1000 addresses per head. Each head will have a different Modbus address.

Hence all Head Registers will be in these ranges: -

Discrete Coils 00001 to 01000
 Discrete Inputs 10001 to 11000
 Input Registers 30001 to 31000

Listed below are the mappings for the data into the registers. Note that these apply per head
 Note that most Modbus Programmes will allocate the most significant address portion from the Type specification or Data Control Function specified.

e.g.:

Function 01 – Read Coil Status	Reads Status of discrete outputs using type 1 memory.
Function 02 – Read Input Status	Reads Status of discrete inputs using type 2 memory.
Function 03 – Read Holding Registers	Reads Holding Registers, type 4 memory.
Function 04 – Read Input Registers	Reads Input Resisters, type 3 memory.
Function 05 – Force Single Coil.	Writes to a status bit, using type 1 memory.

Discrete Coils – Type 1

These when used allow the Modbus master to trigger ACW functionality. Each address accesses one bit.

<u>Address</u>	<u>Set Action</u>	<u>Un-set Action</u>	<u>Status</u>
01	Do AutoZero Now	Not available	Not applicable
02	Do AutoCal Now	Not available	Not applicable
03	Energise Zero Air Solenoid	De-energise	Current Status
04	Energise Autocal Solenoid 1	De-energise	Current Status
05	Energise Autocal Solenoid 2	De-energise	Current Status
06	Energise Autocal Solenoid 3	De-energise	Current Status
07-1000	Spare		

Examples:

- 1) To start an Auto Zero on Head 1 we would set the bit at address 0001 to 1 at Modbus 1.
- 2) To de-energise the Zero Air solenoid on Head 2 we would set the bit at address 0003 to 0 at Modbus 2.

IMPORTANT NOTE: Data in this memory area must be modified using the Modbus Function "Force Single Coil" (Function number 5). The Modbus slave will not respond to function "Force Multiple Coils" (Function 15), the reason being that some of the ACWn functionality triggered from the Modbus Master is mutually exclusive.

Discrete Inputs – Type 2

These holds the different alarm states of each channel, as well as the Head Alarms and Global Alarms. Note that Global Alarms are only present in Head 1.

We have allocated a maximum of 24 channels per P200 or P5000 head and 48 channels per IOU. Each address accesses 1 bit which gives the alarm state (0=OK, 1=ALARM).

Address Mappings:

<u>Address Range</u>	<u>Block</u>	<u>Comment</u>
001-500	Channel Alarms	
501-600	Head Alarms	
601-1000	Extra Derived Channel Alarms or Spare	

Address Mappings for Channel Alarms P200/P500/ACU

<u>Address Range</u>	<u>Channel</u>	<u>Comment</u>
001-020	1	Measured 1
021-040	2	Measured 2
041-060	3	Measured 3
061-080	4	Measured 4
081-100	5	Measured 5
101-120	6	Measured 6
121-140	7	Measured 7
141-160	8	Measured 8
161-180	9	DC Input 1
181-200	10	DC Input 2
201-220	11	DC Input 3
221-240	12	DC Input 4
241-260	13	DC Input 5
261-280	14	DC Input 6
281-300	15	DC Input 7
301-320	16	DC Input 8
321-340	17	Derived 1
341-360	18	Derived 2
361-380	19	Derived 3
381-400	20	Derived 4
401-420	21	Derived 5
421-440	22	Derived 6
441-460	23	Derived 7
461-480	24	Derived 8
481-500	25	Derived 9
601-620	26	Derived10
621-640	27	Derived11 etc.

Note: P200 and P500.

If less than 8 channels per type allocated, unused channels will return zero. DCInputs always start at 161, Derived at 321.

The twenty addresses per channel correspond to the alarms as follows:

<u>Address</u> _____	<u>Alarm</u>	<u>ACW/ACU Alarm Code</u>
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01	Measured Value < Highest LOW alarm	CLO
02	Measured Value < both LOW alarms	CLL
03	Measured Value > Lowest HIGH Alarm	CHI
04	Measured Value > both HIGH alarms	CHH
05	Measured Value either <LOW or >HIGH	CBO
06	Dual channel range	DUA
07	Signal Fault	SIG
08	AutoCal Fault	CAL
09-20	Spare	

Examples:

- 1) To get the CLO alarm for Head 1, Measured 1 we would read address 0001, Modbus 1.
- 2) To get the CAL alarm for Head 2, Measured 5 we would read address 0088, Modbus 2.

Address Mappings for Channel Alarms IOU

<u>Address Range</u>	<u>Channel</u>	<u>Comment</u>
001-010	1	Input Module 1
011-020	2	Input Module 2
021-030	3	Input Module 3
031-040	4	Input Module 4
041-050	5	Input Module 5
051-060	6	Input Module 6
061-070	7	Input Module 7
071-080	8	Input Module 8
081-090	9	Input Module 9
091-100	10	Input Module 10
101-110	11	Input Module 11
111-120	12	Input Module 12
121-130	13	Input Module 13
131-140	14	Input Module 14
141-150	15	Input Module 15
151-160	16	Input Module 16
161-170	17	Input Module 17
171-180	18	Input Module 18
181-190	19	Input Module 19
191-200	20	Input Module 20
201-210	21	Input Module 21
211-220	22	Input Module 22
221-230	23	Input Module 23
231-240	24	Input Module 24
241-250	25	Input Module 25
251-260	26	Input Module 26
261-270	27	Input Module 27
271-280	28	Input Module 28
281-290	29	Input Module 29
291-300	30	Input Module 30
301-310	31	Input Module 31
311-320	32	Input Module 32
321-330	33	Digital Input 1
331-340	34	Digital Input 2
341-350	35	Digital Input 3
351-360	36	Digital Input 4
361-370	37	Digital Input 5
371-380	38	Digital Input 6
381-390	39	Digital Input 7
391-400	40	Digital Input 8
401-410	41	Digital Input 9

411-420	42	Digital Input 10
421-430	43	Digital Input 11
431-440	44	Digital Input 12
441-450	45	Digital Input 13
451-460	46	Digital Input 14
461-470	47	Digital Input 14
471-480	48	Digital Input 16

The ten addresses per IOU channel correspond to the alarms as follows:

<u>Address</u>	<u>Alarm</u>	<u>ACW Alarm Code</u>
01	Measured Value < Highest LOW alarm	CLO
02	Measured Value < both LOW alarms	CLL
03	Measured Value > Lowest HIGH Alarm	CHI
04	Measured Value > both HIGH alarms	CHH
05	Measured Value either <LOW or >HIGH	CBO
06-10	Spare	

Examples:

- 3) To get the CLO alarm for Head 1, Measured 1 we would read address 0001, Modbus 1.
- 4) To get the CHI alarm for Head 2, Digital 5 we would read address 0363, Modbus 2.

Address Mappings for Head Alarms, P200/P5000/IOU

<u>Address</u>	<u>Alarm P200/P500</u>	<u>Alarm IOU</u>	<u>ACW/ACU Alarm Code</u>
501	Autozero In Progress	Not Used	AUZ
502	Head Disconnected	Head Disconnected	CON
503	Filter Wheel Fault	Not Used	WHE
504	RotaSpan Error	Not Used	RSP
505	Head Alarm	Head Alarm	HUN
506	Head Alarm	Head Alarm	HUC
507	Global Alarm if first Head	Global Alarm if first Head	ANN
508	Global Alarm if first Head	Global Alarm if first Head	ANC
509	Beta Vector (P5000)	Not Used	BVE
510	Calibrate In Progress	Not Used	CIP
511 - 600	Spare		

Examples:

- 1) To get the CON alarm for head 1 we would read address 502, Modbus Address 1
- 2) To get all the Head Alarms for head 2 we would read from address 501 to 506, Modbus Address 2

Input Registers – Type 3

These will hold the OHU Identification & Status information, the OHU operating settings, and the Values of each channel. Each address accesses one word, Read only.

Address Mappings:

<u>Address Range</u>	<u>Block</u>	<u>Comment</u>
001-100	OHU ID & Status	
101-200	Operating Settings	
201-300	Channel Values	
301-1000	Spare	

Address Mappings for OHU ID & Status Block

<u>Address</u>	<u>Field Name</u>	<u>Comment</u>
01	Reserved for Slave ID	Head Number
02	Instrument Enabled	Enabled/Disabled Status.
03	Reserved for Identifier Bytes	OHU Serial No
04-100	Spare	

Address Mappings for Operating Settings Block

<u>Address</u>	<u>Field Name</u>	<u>Comment</u>
101	PC Time – Hours	All PC Times for first head only.
102	PC Time – Minutes	
103	PC Time – Year	
104	PC Time – Month	
105	PC Time – Day	
106-107	Autozero Phase	0 – Off 1 – Pending 2 – Air Purge 3 – Zero Measure 4 – Zero Update 5-7 – optional Cal Gas 1 phases 8-10 – optional Cal Gas 2 phases 11-13 – optional Cal Gas 3 phases 14 – Process Purge.
108-109	Solenoid State	-1 – None On 0 – Manual Air Purge 1 – Manual Cal Gas 1 2 – Manual Cal Gas 2 3 – Manual Cal Gas 3
110-200	Spare	

Address Mappings for Channel Values P200/5000/ACU

<u>Address</u>	<u>Field Name P200/P5000/ACU</u>	<u>Field Name IOU</u>
201-202	Channel 1 Measured	DC Channel 1

203-204	Channel 2 Measured	DC Channel 2
205-206	Channel 3 Measured	DC Channel 3
207-208	Channel 4 Measured	DC Channel 4
209-210	Channel 5 Measured	DC Channel 5
211-212	Channel 6 Measured	DC Channel 6
213-214	Channel 7 Measured	DC Channel 7
215-216	Channel 8 Measured	DC Channel 8
217-218	Channel 1 DC Input	DC Channel 9
219-220	Channel 2 DC Input	DC Channel 10
221-222	Channel 3 DC Input	DC Channel 11
223-224	Channel 4 DC Input	DC Channel 12
225-226	Channel 5 DC Input	DC Channel 13
227-228	Channel 6 DC Input	DC Channel 14
229-230	Channel 7 DC Input	DC Channel 15
231-232	Channel 8 DC Input	DC Channel 16
233-234	Channel 1 Derived	DC Channel 17
235-236	Channel 2 Derived	DC Channel 18
237-238	Channel 3 Derived	DC Channel 19
239-240	Channel 4 Derived	DC Channel 20
241-242	Channel 5 Derived	DC Channel 21
243-244	Channel 6 Derived	DC Channel 22
245-246	Channel 7 Derived	DC Channel 23
247-248	Channel 8 Derived	DC Channel 24
249-250	Extra 26 Derived Channels or Spare	DC Channel 25
251-252		DC Channel 26
253-254		DC Channel 27
255-256		DC Channel 28
257-258		DC Channel 29
259-260		DC Channel 30
261-262		DC Channel 31
263-264		DC Channel 32
265-266		DIG INPUT 1
267-268		DIG INPUT 2
269-270		DIG INPUT 3
271-272		DIG INPUT 4
273-274		DIG INPUT 5
275-276		DIG INPUT 6
277-278		DIG INPUT 7
279-280		DIG INPUT 8
281-282		DIG INPUT 9
283-284		DIG INPUT 10
285-286		DIG INPUT 11
287-288		DIG INPUT 12
289-290		DIG INPUT 13
291-292		DIG INPUT 14
293-294		DIG INPUT 15
295-296		DIG INPUT 16
297-298		Spare
299-300		Spare

The values for each channel are actually floating point. The format is to IEEE 754 32 bit format. When accessed via Modbus each value is sent as two 16-bit integers with the high word being send first, hence the two addresses required per channel measurement.

Example addressing – Head 1, DC Input 6 at 227 and 228, Modbus Address 1.
 Head 3, Derived 4 at 239 and 240, Modbus Address 3

Note that if an External Derived Channel is configured it is omitted from the Input Registers and mapped into the Holding Registers.

Holding Registers – Type 4

<u>Address</u>	<u>Field Name P200/P5000</u>
201-202	External Derived Channel 1
203-204	External Derived Channel 2
205-206	External Derived Channel 3
207-208	External Derived Channel 4
209-210	External Derived Channel 5
211-212	External Derived Channel 6
213-214	External Derived Channel 7
215-216	External Derived Channel 8