INTERFACING OMNI-FLOW COMPUTER TO REMOTE OPERATION CONTROLLER (ROC) REMOTE TERMINAL UNIT (RTU) FOR SCADA NETWORK IN SPDC

Tubonimi Jenewari¹, Biobele Alexander Wokoma²

¹Lecturer, Dept. of Elect and Computer Engg, Rivers State University of Sci & Tech, Rivers State, Nigeria ²Grad assistant, Dept. of Elect and Computer Engg, Rivers State University of Sci & Tech, Rivers State, Nigeria

Abstract

Remote operation is a prevalent technology in our time, this has taken deep root even in the oil and gas industry. With the emergence of wireless and wired technology, with different communication protocol ranging from parallel to serial it has made the transfer of data possible and faster. This paper is to provide way for data to be transmitted from Non-Associated Gas (NAG) location Omni-flow computer to a remote location to be used in making production management decision in Shell Petroleum Development Company (SPDC). OMNI 3000 Flow Computers is used in majority of liquid and gas flow measurement and control systems, it uses serial communication protocol RS232; 4 wire – TX, TERM, RX, GRND which has its own limitation for long distance communication, it has keypad function and local display read out, this instance does not have Ethernet port. With the help of remote operation controller (ROC) remote terminal unit (RTU) the data from omni-flow computer can get to supervisory control and data acquisition (SCADA) network via a local area network (LAN) interface. With this other devices and department can use this data points to make meaningful decision from OPC server. ROC RTU has serial communication interface to enable other RTU's communicate with it in master slave or slave master configuration.

Keywords: omni-flow computer, remote operation controller, ROC, RTU, SCADA, serial communication, LAN, RS232, Non-Associated Gas, OPC server, SPDC, shell Nigeria

***_____

1. INTRODUCTION

Gas measurement is essential but without data transfer, operational and billing function will be difficult to handle. In the oil and gas industry it is very important for decision making by other machines, devices or humans. Validation and accounting of production is another key thing. Sales of gas, to other gas station needs to be achieved. It is on this backdrop this paper will be looking at a way of transferring data.

OMNI-flow computers find its use in petrochemical and process measurement facilities. It is applicable to liquid and gas flow measurement, control and communication systems, and custody transfer operations. Various sensors installed on monitoring pipeline are connected to it. It calculates, displays, and prints data that will be used for operational or billing functions. The computer is configured according to the pipe specifications [1].

The data on the display is transferred through remote operation controller (ROC) remote terminal unit (RTU) via RS232 port using modbus RTU modem (Modicon Compatible) protocol Type, which is ideal for field installations where the monitoring, measurement and control of processes and equipment are required. ROCLINK 800 Software is used for the configuration of the ROC RTU.

The means of interface is RS232, a four wire configuration TX, TERM, RX, GRND.

Modbus is an industrial application-layer messaging protocol standard. It provides client/server communication between devices connected on different types of buses or network. Modbus-RTU (Remote Terminal Unit) means that the Modbus protocol is used on top of a serial line with an RS-232, RS-485 or similar physical interface. Numerous automation systems have Modbus-RTU interfaces for communication [2].

In Modbus communication there must be a master and a slave and their protocol must be identical otherwise there will no communication.

2. RELATED CONFIGURATION

2.1 Other Configuration of ROC RTU

Master-slave structure of HART communication protocol means that each message transaction is sent from a master and each slave device only responds when it receives a command that is particularly addressed to it.

2.2 Methodology



Fig 3.1: ROC827 base unit [3]



Fig 3.2: OMNI flow computer [4]



Fig 3.3: network connection

2.3 Configuration of ROC RTU device

Omni flow computer configuration setup information Serial Protocol RS232; 4 wire – TX, TERM, RX, GRND Protocol Type: Modbus RTU Modem (Modicon Compatible) CRC Detection Enabled: Y Baud Rate: 9600 Parity: None Data Bits: 8 Stop Bits: 1 Modbus ID: 2 Transmit Key Delay: 0 ms Modbus ID 2

Point No.: 7034 Point Count 1 Data Type: Float (description: yesterday total export in MMSCF)

Point No.:7032 Point Count:1 Data Type: Float (description: total export from 06:00 AM today until now in MMSCF)

Point No.: 7030 Point Count:1 Data Type: Float (description: current flow rate in MMSCFD)

2.4 Installation and Configuration Process

The ROC 800 link software must be installed on an IBM compatible computer in other to have access to ROC RTU interface for configuration through Local Operator Interface (LOI) port which provides direct communications between the ROC800-Series and the serial port of an operator interface device.

2.4.1 Configuration of the Modbus Slave [5]

- Configure the Modbus operating parameter for the Omni-flow computer
- Create registers for the desired data transfer function at the Omni-flow computer

• Configure communication on RS232

2.4.2 Configuration of the Modbus Host [5]

- Configure the Modbus operating parameter for the ROC RTU
- Create registers that associate incoming slave data with specific ROC TLP data fields
- Construct query
- Configure communication on RS232

To establish RS232 connection between master and slave ROC 800 wiring is shown below

Table 3.1: RS 232 pin connection								
Master	Slave	ROC800						
ROC800 COM2	COM2							
Rx	Tx							
Tx	Rx							
GND	GND							

2.4.3 Configuration Interface [6]

The IP address for the ROC is configured, once connected the status off-line that was indicating red will turn green online below right as shown in the next screen shot.

ROCLINK 800 - [Device Directory]	- 0 X
🔀 File Edit View ROC Configure Meter Utilities Tools Wi	dow Help
🗅 🚅 🖬 🐒 📾 📾 🛃 💭 🍹 🔍 옷 다 개 🐜 [자]	N 🕫 🎗 🔿 🖬 📓 🖳 💕 I 2 💖
Direct Connect Device Root COM 2 Device COM 2 Device Come Comment Modem Device Mement Device Mement Device Mement Device	ROCLINK 800 Communication Parameters Image: Ethernet Device Image:
🧑 📰 🤌 » 😻 2 Fir 🗸 🚹 3 Wi 🗸 📇 ROCLI.	- 💽 Junk E 📑 A6162 💊 Skype 🐧 Untitl 📑 flobus EN 🚔 🙊 🕢 🔊 🔷 🖉 🐐 🖓 🖓 40 14:35
	ig 3 1. ID address configuration screenshot
ſ	ig 5.4. IF address configuration screenshot

A communication port is selected with RS232 type. The baud rate, parity data bit and stop bit are configured according to the slave (OMNI flow computer) information provided

Image: Intermed Processon Processon Market Unitable Strate View ROC Configure Market Unitable Tools Window Help Image: Imag	🖙 ROCLINK 800 - [On Line - Ethernet - ROC800 - ROC 800 N	MASTER]	. 0 X
Image: Source - Ethernet - ROC000 - ROC 8000 MAY Image: Source - Ethernet - ROC000 - ROC 8000 MAY Image: Source - Ethernet - ROC000 - ROC 8000 MAY Image: Source - Ethernet - ROC000 - ROC 8000 MAY Image: Source - Ethernet - ROC000 - ROC 8000 MAY Image: Source - Ethernet - ROC000 - ROC 8000 MAY Image: Source - Ethernet - ROC000 - ROC 8000 MAY Image: Source - Ethernet - ROC000 - ROC 8000 MAY Image: Source - Ethernet - ROC000 - ROC 8000 - ROC 800 - ROC	File Edit View ROC Configure Meter Utilities	Tools Window Help	_ 8 ×
■ Outpute-Ehernet-HOLE202-ROC-800-MST ■ Outpute-Ehernet-HOLE202-ROC-800-ROC-	🗅 📽 🖬 X 🖻 🖻 🕭 🕼 🍡 🍳 🔍 M 1	H 🐜 K/- HF 🞜 ≉ 📀 🖾 🔛 🚰 🗖 💕 ? 🍂	
	Image: Speed of the speed	Comm Port Iag: DDMM2 General Modem SRBX Store & Forward Diagnostics Econom Type: [R5:222] Bud Rate Paily Data Bits Stop Bits Comm Type: [R5:222] Bud Rate Paily Data Bits Stop Bits Comm Type: [R5:222] Bud Rate Paily Data Bits Stop Bits Kay On Delay: Comm Type: [R5:22] Bud Rate Paily Other Common Type: [R5:22] For Downer C 1200 C 2000 C None C 7 C 1 DO Secs Key Olf Delay: C 1122K C 384 K C 100 Secs Key Olf Delay: DOIT Secs Comm 2 C 700 Modus Slave C User Program 1 User Program 1 Delay: DOIT Secs C 76 CD Purp Robool Only C User Program 3 User Program 3 Delay: Doit C User Program 3 C Modus Mater C User Program 6 C User Program 6 C User Program 6 C User Program 7 C LDD C User Program 8 E User Program 8 E User Program 8 E Depty	
		ION-LINE	14:32
🚱 📃 🗟 🤌 💘 2 Firefox 🔹 📋 3 Windo 🔹 🖪 ROCLINK 8 🔗 Junk E-mail 📑 A6162 ROC 👒 Skype" [2] 🛛 EN 🚎 🏀 🛞 🕥 🕥 🔷 🖉 🔞 🛱 📣 1432	🚱 📃 🖻 🥭 👋 🕹 2 Firefox 🔍 📙 3 Wi	indo 🔻 🔄 ROCLINK 8 🛛 🕞 Junk E-mail 📑 A6162 ROC 🧕 Skype" [2] 🛛 EN 👜 🛞 🕢 🕖 🔹 🖉 🙆 🧕 🕰 🌾 🧌	🛃 🕪 14:32
Fig 3.5: RS 232 configuration screenshot		Fig 3.5: RS 232 configuration screenshot	

Master is selected on communication port in modbus configuration with byte order as most significant byte first and communication mode as RTU in the screen shot below

ROCLINK 800 - [On Line - Ethernet - ROC800 - ROC 800 M	USTER)
Modba	us Configuration
	C Odupelu Olusesan
	is online our course 1428
- 🥵 🛋 🔄 🏈 🧶 2 Fir 🔻 📑 3 Wi 👻	🔚 ROCLI 🔽 Junk E 🔁 A6162 📚 Skype 🐧 Untitl 🗃 flobus EN 🚔 🏽 🎖 💿 🗩 🖉 🂊 🍳 🖉 🔞 🗘 436

Fig 3.6: Modbus configuration screenshot

The data soft point is configured in the function code of master table tab as provided from the omni flow computer. In RTU address 2 is entered having number of register as 1

🔄 ROCLINK 800 - [On Line - Ethernet - ROC800 - RO	DC 800 MA	STER]								
File Edit View ROC Configure Meter	Utilities	Fools Wi	ndow Help							_ & ×
🗅 🚅 🖬 X 🖻 🛍 🦽 🗐 🅦 🔍 🔍	Modbus	Configura	tion	1 No. 1		6			? ×	
	Comm I Gene Logie	Port : 4 - M/ eral Scale	ASTER Values Master Table Master MastTbl 7 (MASTER)	r Modem	Registers Tag : Ma	History Ta stTbl 7	ble			
i — — User Display		RTU Address	Function Code	Slave Register	Master Register	Number of Registers	Comm Status		<u> </u>	
	1	2	3 - Read Holding Registers	7034	7034	1	0			
	2	2	3 - Read Holding Registers	7030	7030	1	8			
	3	2	3 - Read Holding Registers	7032	7032	1	8			
	4	2	0 - Disabled	0	0	1	130			
	5	2	0 - Disabled	0	0	1	130			
	6	2	0 - Disabled	0	0	1	130	_		
	7	0	0 - Disabled	0	0	1	0	_		
	8	0	0 - Disabled	0	0	1	0	-		
	9	0	0 - Disabled	0	0	1	0	-		
	10	U	U - Disabled	0	0	1	0	-		
		0	0 Disabled	0	0	1	0	-		
	12	0	0 - Disabled	0	0	1	0	-		
	14	0	0 - Disabled	0	0	1	0	-		
	15	0	0 - Disabled	0	0	1	0	-		
	16	0	0 · Disabled	0	0	1	0	-		
	17	0	0 - Disabled	0	0	1	0			
	18	0	0 - Disabled	0	0	1	0			
	19	0	0 - Disabled	0	0	1	0			
	20	0	0 - Disabled	0	0	1	0		-	
							🗿 Update 🛛 🔪	🗸 OK 🛛 🗙 Cance	el <u> Apply</u>	
< III >	_	-		-	-	-	-			
,										ON-LINE 14:37
🛛 🛃 🔄 🐣 👋 🕹 2 Fir 🗸 📑 3	Wi	🖙 ROCLI	🚫 Junk E 🔁 Að	162	Skype	.) 👔	Untitl 📲	flobus EN 📻		💿 🚽 < 🖉 闷 🍳 🧿 🗲 🏉 👘 🕄 🕪 14:37
		T10 /		1 .		C			1 .	

Fig 3.7: Modbus data point configuration screenshot

In figure 3.8 after entering the start and end registere the right conversion value must be entered in this case 25 in

other get a soft point read out in exact with the local read out of omni flow computer

🖙 ROCLINK 800 - [On Line - Ethernet - ROC800 - R	DC 800 N	MASTER]									IJ
File Edit View ROC Configure Meter	Utilities	Tools Window	v Help							- 8 2	×
n 🚅 🖬 X 🖻 🖻 🗇 🚡 Q' Q'	Madk	our Configuration	8.4.0		1.47			? x			
	Ge	eneral Scale Value able : 7 •	rs Master Tab Tag : Reg Ma End Register	vle Master Modern Reg p 7 Device Parameter(s)	isters History	Table Conversion	Comm Port				
E III Osol Display		1 7034	7034	SFP 1, DATA1	Parameter	25	MASTER				l
		2 7030	7030	SFP 1, DATA2	Parameter	25	MASTER				l
		3 7032	7032	SFP 1, DATA3	Parameter	25	MASTER				l
		4 0	0	Undefined	Point	0	MASTER				l
		5 0	0	Undefined	Point	0	MASTER				l
		6 0	0	Undefined	Point	0	MASTER				l
		7 0	0	Undefined	Point	0	All Comm Ports				1
		8 0	0	Undefined	Point	0	All Comm Ports				l
		9 0	0	Undefined	Point	0	All Comm Ports				1
		10 0	0	Undefined	Point	0	All Comm Ports				ł
		11 0	0	Undefined	Point	0	All Comm Ports				1
		12 0	0	Undefined	Point	0	All Comm Ports				ł
		13 0	0	Undefined	Point	0	All Comm Ports				l
		15 0	0	Undefined	Point	0	All Comm Ports				ł
		15 0	U	Unidelined	Fun	0	All Collin Ports				ł
											ł
											l
											ł
											l
											ł
											l
											ł
											l
						🔹 Update	e 🖌 OK 🕺 Kan	icel ! Apply			f
											l
< III >											1
									ON-LINE	14:37	
🛃 📰 🥭 👋 🎱 2 Fir 🗸 🚹 3	Wi	ROCLI	🚫 Junk E	🔁 A6162 🔕	Skype	Untitl	🔄 flobus EN 🗑	- 8 (1)	💿 🚽 < 🔮 💿 💿 🌰 🌀 🧌 🕄	14:37	
		E'~ 2 0.	Madl			. C					

Fig 3.8: Modbus conversion configuration screenshot

Figure 3.9 screen shot shows the data that is transmitted remotely from the slave (omni-flow computer) to the master (ROC RTU) which is the same.

E ROCLINK 800 - [On Line - Ethernet - ROC800 - ROC 800 MASTER]	_ 0 X
File Edit View ROC Configure Meter Utilities Tools Window Help	_ 8 ×
ᆸᄚᇣᆝᅕᄩᅊᆝᄻᄲᅋᅸᇃᅋᆞᅋᆟᄽᆊᅑᆙᄹᆊᅕᄷᄿᆿᅆᅆᅝᄤᆙᅋᄬᆝᆞᅇᆥ	
B A Do Line - Ethemet - ROC800 - ROC 800 MAS' B Meter Meter Meter B B Hidoy B = B User Program B = B User Display Soft Point: 1 - Soft Pt 01 Tag: Soft P0 1 Palameters Polant Palameters Polant Palameters Polant Status 1 000 2 4958919 12 000 3 5440192 13 00 4 51012.477 14 000 5 4832427 15 000 6 00 16 00 7 00 18 00 9 00 19 00 10 00 20 00 10 00 10 0 10 00 20 00 10 00 10 0 10 00 10 0 10 00 10 0 10 00 10 0 10 00 10 0	
< m +	
	ON-LINE 14:38
🚯 🖃 🗟 🖉 🐣 👋 🕹 2 Fir 🔻 📋 3 Wi 🔻 🚍 ROCLI 闷 Junk E 📑 A5162 🔌 Skype 🐧 Untitl 📲 flobus EN 🗃 🛞 🚱 🚱 🚱	く 🔄 😒 🔞 🧟 🍊 🇳 i 🤮 🏟 14:38

Fig 3.9: soft point readout screenshot

3. CONCLUSION

The omni-flow computer installed was without ethernet interface it became necessary to get data from it to remote OPC server for decision making therefore a means of achieving this was made possible by the available ROC800 series RTU as at then. The configuration of the omni-flow computer was provided including the soft point registers. The challenge in this configuration exercise was the conversion value that was not made available, several arbitrary values was sequentially selected until the exact value of twenty five (25) was gotten which took almost a week on the work bench to accomplish.

REFERENCES

- [1]. http://www.omniflow.com/products/Products
- [2]. http://www.anybus.com/technologies/modbustcp2.shtml
- [3]. ROC 809 instruction manual February 2005
- [4]. Configuration and advance operation volume 3, omni 3000/6000 flow computer user manual
- [5]. ROC 800 series shell oil support; july 2011
- [6]. ROCLINK 800 configuration software user manual

BIOGRAPHIES



He graduated and obtained a B.Tech degree in Electronics Engineering in Rivers State University of Science & Technology where he is working presently, after his first degree he worked for some years before proceeding for further studies. In 2008,

he obtained MSc. in mobile personal and satellite

communication in the University of Westminster, UK. Within this period he also attended the Institute of Engineering and Technology and obtained a level 3 certificate in the requirement for electrical installations (BS7671 2008). He is enthusiastic in electronic and telecoms design and has his own small lab for PLC, embedded system, etc.



He studied and obtained a B.Tech degree in Electrical Engineering (Electronics Option) from the Rivers State University, where he works at present. He is presently a post graduate student in the university of Port Harcourt, Rivers State, Nigeria, where

he is studying Electronics & Telecommunication Engineering (M.Eng).