

Table Of Contents

Chapter	Description	Page
1.	NETWORK COMPONENTS.....	1—1
1.1	Trunk Cable.....	1—2
1.1.1	Twisted Pair.....	1—2
1.1.2	Fiber Optic Cable.....	1—2
1.1.3	Clustered Node Devices.....	1—3
1.1.4	Cluster Configurations.....	1—4
1.1.5	Mixed Clustered Nodes.....	1—5
1.1.6	Terminated Clustered Nodes.....	1—6
1.1.7	Principles of Clustered Nodes.....	1—7
1.1.8	Clustered Taps.....	1—8
1.1.9	T-Connectors.....	1—8
1.2	Modbus Plus Tap Wiring.....	1—9
1.3	Drop Cable.....	1—9
1.4	Termination Wiring.....	1—10
1.4.1	Trunk Cable Connections.....	1—10
1.4.2	Drop Cable Connections.....	1—11
1.5	Repeaters.....	1—12
1.5.1	RR 85 Repeater Front View.....	1—12
1.5.2	RR 85 Repeater Rear View.....	1—12
1.6	Bridges.....	1—13
1.6.1	BP 85-000 Bridge Plus Front View.....	1—13
1.6.2	BP 85-000 Bridge Plus Rear View.....	1—14
1.6.3	BP 85-002 Bridge Plus Front View.....	1—16
1.6.4	BP 85-002 Bridge Plus Rear View.....	1—16
1.6.5	BM 85-000 Bridge/MUX Front View.....	1—19
1.6.6	BM 85-000 Bridge/MUX Rear View.....	1—19
1.6.7	BM-85 Different Models.....	1—21
1.6.8	Fiber Optic Repeater 490NRP954 Front View.....	1—22
1.6.9	Fiber Optic Repeater 490NRP954 Rear View.....	1—22
1.6.10	Fiber Optic Repeater 490NRP254 Front View.....	1—23
1.6.11	Fiber Optic Repeater 490NRP254 Rear View.....	1—23
1.6.12	Fiber Optic Repeater 490NRP253 Front View.....	1—24
1.6.13	Fiber Optic Repeater 490NRP253 Rear View.....	1—24
1.6.14	PCMCIA Card.....	1—25
1.6.15	PCMCIA Card and Adapter.....	1—25
2.	MODBUS PLUS STRUCTURE.....	2—1
2.1	Node Access.....	2—2
2.2	LED Port Indications.....	2—5

Chapter	Description	Page
2.2.1	Modbus Plus LED Lights	2—6
2.2.2	Status Word Four (4)	2—6
2.3	Data Communications Paths	2—7
2.3.1	Data Master Path	2—7
2.3.2	Data Slave Path	2—7
2.3.3	Program Master Path	2—7
2.3.4	Program Slave Path	2—8
2.4	MSTR Data Handling	2—8
2.4.1	Source of Data	2—8
2.4.2	Destination receiving Data	2—8
2.4.3	Program Path Data Handling	2—8
2.4.4	Bridging Modbus Port to MB+ Port	2—8
2.4.5	Peer to Peer Communications Paths	2—9
2.4.6	Multiple Scans	2—10
2.5	BP85 Bridge Plus Queuing	2—10
2.6	Network Communications Operation Codes	2—11
2.7	MSTR Function Block	2—12
2.8	Control Area (4xxxx)	2—12
2.8.1	4xxxx Operation Codes	2—13
2.8.2	4xxxx + 1 Error Status Codes	2—14
2.8.3	4xxxx +2 Length	2—16
2.8.4	4xxxx + 3 Register Offset	2—16
2.8.5	4xxxx + 4 First Routing Register	2—16
2.8.6	First Routing Register	2—18
2.8.7	Example Control Area	2—18
2.8.8	Control Area for TCP/IP Ethernet	2—19
2.8.9	Control Area for Sy/Max Ethernet	2—19
2.9	Data Area	2—20
2.9.1	Example Data Area	2—20
2.10	Data Area Size (00###)	2—21
2.10.1	Example Area Size	2—21
2.11	MSTR Function Block Inputs	2—22
2.11.1	Top Input	2—22
2.11.2	Middle Input, Abort Operation	2—23
2.11.3	Bottom Input	2—23
2.12	MSTR Function Block Outputs	2—24
2.12.1	Top Output, Function Active	2—24
2.12.2	Middle Output, Error Condition	2—24
2.12.3	Bottom Output, Function Complete	2—24
2.13	Status Information	2—25
2.13.1	Get Local Statistics	2—25

Chapter	Description	Page
	2.13.2 Clear Local Statistics	2—25
	2.13.3 Read / Write; Get / Clear Remote Statistics.....	2—25
2.14	MSTR for DIO.....	2—27
2.15	Control Area (4xxxx)	2—27
2.16	Data Area.....	2—28
2.17	Data Area Size (00###).....	2—28
	2.17.1 Drop RAM Table	2—29
	2.17.2 Monitoring DIO Module Status	2—29
	2.17.3 DIO Solve Time	2—30
	2.17.4 Write Global Data	2—31
	2.17.5 Read Global Data	2—31
3.	PEER TO PEER MODBUS PLUS COMMUNICATIONS.....	3—1
3.1	Peer To Peer Communications.....	3—2
3.2	MSTR Function Block, Peer to Peer communication.....	3—2
	3.2.1 Control Area Registers.....	3—3
	3.2.2 Data Area Registers.....	3—3
	3.2.3 Data Area Size	3—3
3.3	Peer to Peer Write	3—4
	3.3.1 Control Area Registers.....	3—4
	3.3.2 Data Area	3—5
	3.3.3 Data Area Size	3—5
3.4	Peer to Peer Write and Read.....	3—6
	3.4.1 Operation Type.....	3—6
	3.4.2 Error Status Codes.....	3—6
	3.4.3 Modbus Plus and Sy/Max Ethernet Error Codes.....	3—7
	3.4.4 Length.....	3—8
	3.4.5 Modbus Plus Routing.....	3—8
3.5	Get Local Statistics	3—9
	3.5.1 Control Area Registers.....	3—9
	3.5.2 Operation Type.....	3—10
	3.5.3 Error Status	3—10
	3.5.4 Length.....	3—10
	3.5.5 Offset Available Words	3—10
3.6	Clear Local Statistics	3—11
	3.6.1 Control Area Registers.....	3—11
	3.6.2 Operation Type.....	3—12
	3.6.3 Error Status	3—12
3.7	Modbus Plus Network Statistics.....	3—13
	3.7.1 Status Word 00.....	3—13
	3.7.2 Status Word 01.....	3—13
	3.7.3 Status Word 02.....	3—14

Chapter	Description	Page
	3.7.4 Status Word 03	3—14
	3.7.5 Status Word 04	3—15
	3.7.6 Status Words 05 thru 19	3—16
	3.7.7 Status Words 20 thru 36	3—17
	3.7.8 Status Words 37 thru 53	3—18
4.	GLOBAL DATABASE.....	4—1
4.1	Global Memory Locations	4—1
4.2	Write Global Database.....	4—2
4.2.1	Control Area Registers	4—3
4.2.2	Operation Type	4—3
4.2.3	Error Status	4—3
4.2.4	Length	4—3
4.2.5	Routing	4—4
4.2.6	Data Area	4—4
4.2.7	Data Area Size	4—4
4.2.8	Global Write	4—5
4.3	Read Global Database.....	4—6
4.3.1	Control Area Registers	4—6
4.3.2	Operation Type	4—7
4.3.3	Error Status Codes	4—7
4.3.4	Length	4—8
4.3.5	Available Words	4—9
4.3.6	Routing 1	4—9
4.3.7	Control Area Registers	4—9
4.3.8	Data Area Registers.....	4—9
4.3.9	Data Area Size	4—10
4.3.10	Global Read	4—10
4.4	Get Remote Statistics	4—11
4.5	Control Area Registers, Modbus Plus	4—11
4.5.1	Operation Type	4—12
4.5.2	Error Status	4—12
4.5.3	Length	4—12
4.5.4	Offset (Available Words).....	4—12
4.5.5	Routing 1-5.....	4—12
4.6	Clear Remote Statistics	4—13
4.7	Control Area Registers, Modbus Plus	4—13
4.7.1	Operation Type	4—13
4.7.2	Error Status Codes	4—13
4.7.3	Modbus Plus Routing 1-5	4—13
5.	PEER COP	5—1
5.1.1	Specific I/O	5—1
5.1.2	Global I/O	5—1
5.2	Sending Peer Cop Data.....	5—2

Chapter	Description	Page
	5.2.1 Global Output.....	5—2
	5.2.2 Specific Output.....	5—2
5.3	Receiving Peer Cop Data.....	5—2
	5.3.1 Global Input	5—2
	5.3.2 Specific Input	5—2
5.4	Peer Cop Configuration.....	5—3
	5.4.1 Select Config Extensions	5—4
	5.4.2 Add Extension Type	5—5
	5.4.3 Peer Cop Selected.....	5—6
	5.4.4 Configuring Specific I/O Nodes.....	5—7
	5.4.5 Configuring Global I/O Nodes	5—8
	5.4.6 Global Inputs and Sub Fields	5—9
	5.4.7 Advantages of Peer Cop	5—10
5.5	Peer Cop Communications Health Status.....	5—11
	5.5.1 Words 0 thru 3, Global Inputs	5—11
	5.5.2 Words 4 thru 7, Specific Outputs	5—12
	5.5.3 Words 8 thru 11, Specific Inputs	5—12
6.	ETHERNET MODULE STATUS	6—1
6.1	Get Remote TCP/IP Ethernet Status	6—1
6.2	Control Area Registers	6—2
	6.2.1 Operation Type.....	6—2
	6.2.2 Error Status	6—2
	6.2.3 TCP/IP Ethernet Error Codes	6—3
	6.2.4 TCP/IP Ethernet Error Codes	6—4
	6.2.5 TCP/IP Ethernet Error Codes	6—5
	6.2.6 Length.....	6—5
	6.2.7 Offset (Available Words).....	6—6
	6.2.8 Routing 1-5	6—6
6.3	Clear Remote Status TCP/IP Ethernet	6—7
	6.3.1 Control Area Registers.....	6—7
	6.3.2 Operation Type.....	6—7
	6.3.3 Error Status Codes.....	6—7
	6.3.4 Modbus Plus Routing 1-5.....	6—7
6.4	Reset Option, Ethernet Modules	6—8
	6.4.1 MSTR Function Block, Control Area TCP/IP Ethernet	6—8
6.5	Read Configuration Table Extension, (CTE).....	6—9
	6.5.1 MSTR Function Block, Control Area TCP/IP Ethernet	6—9
	6.5.2 MSTR Function Block, Control Area Sy/Max Ethernet	6—10
	6.5.3 Configuration Extension Table Values	6—10
	6.5.4 MSTR Function Block Control Area	6—11
6.6	Write Configuration Table Extension, (CTE).....	6—12
	6.6.1 MSTR Function Block, Control Area TCP/IP Ethernet	6—13

Chapter	Description	Page
	6.6.2 MSTR Function Block, Control Area Sy/Max Ethernet	6—13
	6.6.3 Configuration Extension Table Values	6—14
	6.6.4 CTE Error Codes for TCP/IP Ethernet and Sy/Max	6—14
	6.6.5 Sy/Max Specific Error Codes	6—15
7.	NETWORK LAYERED COMMUNICATION	7—1
7.1	Network Response Time: Concept and Formulas	7—2
7.1.1	Worst Case Response Time	7—2
7.1.2	Average Response Time	7—2
7.1.3	Token Rotation Time	7—3
7.2	TEST #1	7—6
7.3	TEST #2	7—6
7.4	TEST #3	7—6
7.5	TEST #4	7—6
7.5.1	Token Rotation Time of Network A (TRA)	7—7
7.5.2	Token Rotation Time of Network B (TRB)	7—7
7.5.3	Average Response Time	7—8
7.5.4	Worst Case Response Time	7—8
7.6	TEST #1	7—9
7.6.1	Test #1 Results	7—10
7.7	TEST #2	7—13
7.7.1	Test #2 Calculated vs Actual Response Time Data	7—14
7.8	TEST #3	7—17
7.8.1	Test #3 Calculated vs Actual Response Time Data	7—18
7.9	TEST #4	7—19
7.9.1	Test #4 Calculated vs Actual Response Time Data	7—20
7.10	Conclusion	7—21
7.10.1	Actual Response Time Data for Tests 1 Through 4	7—22

Table Of Figures

Figure	Description	Page
Figure 1-1	Clustered Configuration	1—4
Figure 1-2	Mixed Single and Clustered Nodes	1—5
Figure 1-3	Terminated Clustered Nodes.....	1—6
Figure 1-4	Clustered Drop Cable Tap Terminations	1—8
Figure 1-5	T_Connector	1—8
Figure 1-6	Modbus Connector Tap Wiring.....	1—9
Figure 1-7	Drop Cable Connection	1—9
Figure 1-8	Modbus Connector Tap Termination	1—10
Figure 1-9	Drop Cable Wire Terminal Connections	1—11
Figure 1-10	RR85 Repeater Front View.....	1—12
Figure 1-11	RR85 Repeater Rear View.....	1—12
Figure 1-12	BP85-000 Repeater Front View	1—13
Figure 1-13	BP85-000 Repeater Rear View	1—14
Figure 1-14	Modbus Plus Address Dip Switch Settings	1—15
Figure 1-15	BP85-002 Repeater Front View	1—16
Figure 1-16	BP85-002 Repeater Rear View	1—16
Figure 1-17	Modbus Plus Address Dip Switch Settings	1—17
Figure 1-18	Bridge Plus Query	1—18
Figure 1-19	BP85-002 Repeater Front View	1—19
Figure 1-20	BP85-002 Repeater Rear View	1—19
Figure 1-21	Modbus Plus Address Dip Switch Settings	1—20
Figure 1-22	BM-85 Rear Panel View.....	1—21
Figure 1-23	490NRP954 Fiber Optic Repeater Front View	1—22
Figure 1-24	490NRP954 Fiber Optic Repeater Rear View	1—22
Figure 1-25	490NRP254 Fiber Optic Repeater Front View	1—23
Figure 1-26	490NRP254 Fiber Optic Repeater Rear View	1—23

Figure	Description	Page
Figure 1-27	490NRP253 Fiber Optic Repeater Front View	1—24
Figure 1-28	490NRP253 Fiber Optic Repeater Rear View	1—24
Figure 1-29	PCMCIA Card	1—25
Figure 1-30	PCMCIA Card and Adapter	1—25
Figure 2-1	Token Rotation of Nodes	2—2
Figure 2-2	Levels of Communications	2—3
Figure 2-3	Peer to Peer Communications	2—9
Figure 2-4	MSTR Block Format	2—12
Figure 2-5	MSTR Block Format	2—22
Figure 2-6	MSTR Block Format	2—24
Figure 2-7	MSTR Block Format	2—27
Figure 2-8	Comparison of MB+ to Remote I/O	2—30
Figure 3-1	Master Function Block	3—2
Figure 3-2	Peer To Peer Application	3—4
Figure 3-3	Peer to Peer Operation	3—9
Figure 3-4	Get Local Statistics	3—11
Figure 4-1	Global Memory Locations	4—1
Figure 4-2	Master Function Block	4—2
Figure 4-3	MSTR Global Write	4—5
Figure 4-4	Read Global Database	4—6
Figure 4-5	MSTR Global Read	4—10
Figure 5-1	Controller Configuration	5—3
Figure 5-2	Select Configuration Extension	5—4
Figure 5-3	Add Extension Type	5—5
Figure 5-4	Specific I/O Selected	5—6
Figure 5-5	Configure Specific I/O	5—7
Figure 5-6	Global I/O Configuration	5—8
Figure 5-7	Global Inputs and Sub Fields	5—9

Figure	Description	Page
Figure 6-1	Modbus Plus Master Function Block	6—1
Figure 6-2	Master Function Block	6—9
Figure 6-3	MSTR Function.....	6—10
Figure 6-4	MSTR Function Block	6—12
Figure 7-1	Two Layer Network	7—5
Figure 7-2	Token Rotation Response Time	7—10
Figure 7-3	Token Rotation Second Test	7—14
Figure 7-4	Token Rotation Test #3.....	7—18
Figure 7-5	Token Rotation Test #4.....	7—20
Figure 7-6	Token Rotation All Four Tests	7—22

This Page Left Intentionally Blank for Notes.