PROGRESSIVE
INTERNATIONAL
E L E C T R O N I C S

PEI
MEMBER

RLM3
Remote Line Monitor Systems

Development Guide

Development Guide
RLM3

TABLE OF CONTENTS

RLM3

HISTORY OF DOCUMENT REVISIONS

Version 1.0 – March 2016
    Initial release

Version 1.1 – May 2016
    Added Commands

Version 1.2 – October 2016
    GENERAL INFORMATION, Description and Application
        Added additional details
    EXPLANATION OF COMMANDS, Meter Request Command — M,
    Representations in Command
        Corrected previous omission

PURPOSE OF THIS DOCUMENT

This manual describes in detail the protocol used with the RLM3. Instructions for installing or servicing the RLM3, dispensers and POS terminals are not included. Additional documentation is available from PIE for RLM3 hardware installation. For more detail on any product not manufactured by PIE, always refer to that product's accompanying documentation.

NOTICE

Progressive International Electronics reserves the right to revise and improve this document as required. This publication details our RLM3 at this time, and may not accurately describe these products at all times in the future. Specifications are subject to change without notice. The latest versions of our documentation can always be found on our website, www.pie-corp.com

COPYRIGHT

EXPLANATION OF DOCUMENT STANDARDS

The following documentation standards are applied throughout this document.

I	Comments are noted in italics.
Spaces	In formats for commands, spaces between fields are used for clarification only. Spaces should not be included in the actual string sent to the controller.
[ ]	Numbers shown in square brackets represent hex values, such as [0x20].

These abbreviations are used.

MOP	Method of payment
MPD	Multiple product dispenser
PIE	Progressive International Electronics, Inc.
SPD	Single product dispenser

RLM3
GENERAL INFORMATION

Description and Application

The RLM3 is a patented device used to monitor communications between a controller and a dispenser. It extracts and stores the data collected. An example of its application is the RLM3 collecting data on fuel sales to assist in fuel inventory reconciliation.

Each RLM3 can support up to 32 fueling positions. The output of the RLM3 is communicated in "banks" of 16 fueling positions at a time. Up to 10 RLM3 units can be daisy-chained in order to support a total of 320 fueling positions.

DISCLAIMER: The RLM device is used to gather information sent between the dispenser controller and the dispenser. This information is intended to be used to determine how the system is operating and to allow a device to read this information. The RLM is primarily detecting information and is not in control, so some data can be lost. The information stored in the RLM is to be used for statistical determination, and should not be considered to be absolute and error free. Care should be taken when utilizing the RLM information, and it is understood that not all data may be captured.

Simplicity of Operation

The RLM3 command protocol is simple, yet quite powerful in its application. As an example, the T command is used to read a string of fueling position and grade totals. Up to 16 fueling position/grade totals may be requested in a single command, and totals will be returned in the order requested. With electronic dispensers, if a fueling position or grade is busy, the request is aborted and a Busy response is returned. If all the requested fueling positions/grades are idle, the volumes of all requested are returned in the same order requested, separated by a "space" character. Each total is 10 digits, with an implied decimal point at the one-thousandths of a gallon (i.e., XXXXXXX.XXX). Since the RLM is only detecting communication – and not in control – the information stored in the RLM should be used for statistical analysis and <u>not</u> considered to be exact, error free data.

Commands and Response Time

The RLM3 communicates over an RS232 or RS485 connection. A "turn-around delay" of 50 milliseconds – which means that the RLM3 will begin to respond to a valid command 50 milliseconds after receipt of the last command byte – is optional and is controlled by a dip switch setting. Baud rates, parity, stop bits, data bits and device addressing are all user-selectable. Baud rates are 9600, 4800, 2400 and 1200. Two stop bits can be selected, as well as seven or eight data bits.

Note: A setting with a combination 8 data bits, even or odd parity and 2 stop bits cannot be selected.

The RLM3 has a built-in RS232 to RS485 converter so the connection to the first RLM3 can be RS232, while the second RLM3 can be RS485. The RTS signal is used to switch the RS485 driver between Transmit and Receive.

Refer to the RLM3 Installation Guide for dip switch settings. See Command Protocol Definitions, following in this manual, for further explanation.

RLM3
GENERAL COMMAND PROTOCOL

Device Address

Each RLM3 is set to a unique physical address via dip switch. This address allows multiple devices to exist on the sale multi-drop network (such as RS485). To allow the RLM3 to work with more than 16 fueling positions on certain systems, the protocol uses a bank select, along with the physical device address set on the RLM3, to produce the full address.

Address Format

:XY [RLM3 command] <EOT><CS>

       Where X is the bank select
             0=fueling position 1 to 16
             1=fueling position 17 to 32
       Where Y is the physical device address 0 to 9

Representations in Commands	
:	ASCII Colon
XY	Device Address — 2 ASCII digits in decimal (See Address Format, above)
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits

Example of Check Sum Calculation

Check Sum <CS> = 2's complement of all the characters, starting with ':' up to and including <EOT> masked off the 7 bits, as shown below:

:00V 000 001 002 003<EOT><CS>

3A 30 30 56 20 30 30 30 20 30 30 31 20 30 30 32 20 30 30 33 04<C S>
Sum = 0x03BA (':' to and including EOT)

0x0000 - 0x03BA = 0xFC46 ← mask off to 7 bits = 0x46

RLM3
EXPLANATION OF COMMANDS

Price Request Command — P

Retrieves all known PPUs for a given fueling position

Command

:XYPFP<EOT><CS>

Response

:XYP<s>ppppqqqq<s>ppppqqqq...ppppqqqq<EOT><CS>

Representations in Command	
:	ASCII Colon
XY	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
FP	Fueling Position — 2 ASCII digits in decimal
P	PPU Request Command
s	Space Character (0x20) used as delimiter for data in command and the response — note that there is no space preceding the <EOT>
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits
p	PPU Data (cash)
q	PPU Data (credit)
	Note that 4 bytes of cash and 4 bytes of credit will be returned for each grade, times 8 grades (64 bytes total returned data)

RLM3
EXPLANATION OF COMMANDS

Reset Command — R

Zeroes all totals being stored

Warning: This command clears ALL totals data. It should be used carefully, under extreme circumstances only.

Command

:XYR<EOT><CS>

Response

:XYR[flag]<EOT><CS>

Representations in Command	
:	ASCII Colon
XY	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
R	Reset Command
flag	Reset Response Flag 　　　0　　　OK 　　　2　　　Command error
s	Space Character (0x20) used as delimiter for data in command and the response — note that there is no space preceding the <EOT>)
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits

RLM3
EXPLANATION OF COMMANDS

Current Volume Command — V

Retrieves current stored volume totals in the order in which they are requested

Note that volume totals is preceded by a flag to indicate whether the fueling position is Busy or Idle. Some dispenser brands do not increment volume of sales in progress and will only report volume after the sale is completed.

Command

:XYV<s>FPH<s>PPH...<EOT><CS>

Response

:XYV00<s>SVVVVVVVVV<s>SVVVVVVVVV...<EOT><CS>

Representations in Command	
:	ASCII Colon
0	ASCII Zero
XY	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
V	Current Volume Command

flag	Volume Response Flag
	     0 OK with data following
	     2 Command error

S	Current Fueling Position Status
	     I Idle
	     B Busy

s	Space Character (0x20) used as delimiter for data in command and the response — note that there is no space preceding the <EOT>
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits
V	Volume Data

RLM3
EXPLANATION OF COMMANDS

Sales Request Command — S

Retrieves volume, credit and cash totals for selected fueling position

All eight grades are returned. The sequence V...R...C... is repeated eight times for the eight grades, sequentially for grade 1 through grade 8. Each grade is separated by a space character.

Command

:XYSFP<EOT><CS>

Response

:XYS[flag]VvvvvvvvvvRrrrrrrrrrCccccccccc<s>
      VvvvvvvvvvRrrrrrrrrrCccccccccc<s>
      VvvvvvvvvvRrrrrrrrrrCccccccccc<s>
      VvvvvvvvvvRrrrrrrrrrCccccccccc<s>
      VvvvvvvvvvRrrrrrrrrrCccccccccc<s>
      VvvvvvvvvvRrrrrrrrrrCccccccccc<s>
      VvvvvvvvvvRrrrrrrrrrCccccccccc<s>
      VvvvvvvvvvRrrrrrrrrrCccccccccc<s>< EOT><CS>

Representations in Command	
:	ASCII Colon
XY	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
FP	Fueling Position
S	Sales Request Command

flag	Totals Response Flag
	    0 OK with data following
	    2 Command error

s	Space Character (0x20) used as delimiter for data in command and the response — note that there is no space preceding the \<EOT\>
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits
v	Volume Data
r	$ Credit Data
c	$ Cash Data
V	Volume Delimiter
R	$ Credit Delimiter
C	$ Cash Delimiter

RLM3
EXPLANATION OF COMMANDS

Totals Request Command — T

Retrieves volume totals in the order in which they are requested

Command

:XYT<s>FPG<s>FPG ... FPG<EOT><CS>

Response

:XYT[flag]<s>VVVVVVVV<s>VVVVVVVV...VVVVVVVV<EOT><CS>

Representations in Command	
:	ASCII Colon
XY	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
FP	Fueling Position
G	Grade
T	Totals Request Command
flag	Volume Response Flag 0 OK with data following 1 1one or more fueling positions busy 2 Command error
s	Space Character (0x20) used as delimiter for data in command and the response — note that there is no space preceding the <EOT>
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits
V	Volume Data

RLM3
EXPLANATION OF COMMANDS

Meter Request Command — M

Retrieves 10-digit totals for accumulated volume and dispenser meter totals for all eight grades

Note that most dispensers will only have 1, 2, 3, 4, 5 or 6 grades. All 8 will be returned with unused grades showing as zeroes. Grades will be returned sequentially, 1-8.

Command

:XYM<s>FP<EOT><CS>

Response

:XYM<s>TTTTTTTTTT<s>MMMMMMMMMM<s>....<EOT><CS>

Representations in Command	
:	ASCII Colon
XY	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
M	Meter Request Command
FP	Fueling Position
s	Space Character (0x20) used as delimiter for data in command and the response — note that there is no space preceding the <EOT>
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits
T	Accumulated Totals
M	Dispenser Meter Totals

RLM3
EXPLANATION OF COMMANDS

Current Credit Request Command — C

Retrieves credit totals for selected fueling positions

Note that specified grades are returned. The value is preceded by the current status of the fueling position. Each grade is separated by space character. Two ASCII zeroes follow the command in the response.

Command

:XYC<s>FPG....FPG<EOT><CS>

Response

:XYC00<s>SRRRRRRRRRR<s>SRRRRRRRRRR.....<s>SRRRRRRRRRR<EOT><CS>

Representations in Command	
:	ASCII Colon
XY	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
C	Current Credit Request Command
FP	Fueling Position
G	Grade
00	2 ASCII zeroes
S	Current Fueling Position Status (0=OK / 2=Command Error)
R	Accumulated Credit Totals
s	Space Character (0x20) used as delimiter for data in command and the response — note that there is no space preceding the <EOT>
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits

RLM3
EXPLANATION OF COMMANDS

Current Cash Request Command — A

Retrieves cash totals for selected fueling positions

Note that specified grades are returned. The value is preceded by the current status of the fueling position. Each grade is separated by space character. Two ASCII zeroes follow the command in the response.

Command

:XYA<s>FPG......FPG<EOT><CS>

Response

:XYA00<s>SCCCCCCCCCC<s>SCCCCCCCCCC....<s>SCCCCCCCCCC<EOT><CS>

Representations in Command	
:	ASCII Colon
XY	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
A	Current Cash Request Command
FP	Fueling Position
G	Grade
00	2 ASCII zeroes
S	Current Fueling Position Status (0=OK / 2=Command Error)
C	Accumulated Cash Totals
s	Space Character (0x20) used as delimiter for data in command and the response — note that there is no space preceding the <EOT>
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits

RLM3
EXPLANATION OF COMMANDS

Load Total Command — L

Stores values of selected locations (fueling positions/grades) in RLM3 database

Command

:XYLFPGVVVVVVVVVV<EOT><CS>

Response

:XYL[flag]<EOT><CS>

Representations in Command	
:	ASCII Colon
XY	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
L	Load Total Command
FP	Fueling Position
G	Grade
V	10-digit value to be stored
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits

RLM3
EXPLANATION OF COMMANDS

Status Request Command — Y

Returns the current status and handle number of all fueling positions (up to 16)

Note that for Wayne dispensers, the handle number is a position number. For non-blenders, the handle number is the Hose/Grade number. For blenders, the hose number is the position number 2-6, with 1 being the single product (if configured).

Command

:XXY<EOT><CS>

Response

:XXYSHSHSH....SH<EOT><CS>

Representations in Command	
:	ASCII Colon
XX	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
Y	Status Request Command

S	Status of Position
	    I Idle
	    H Dispenser Handle Lifted
	    A Dispenser Armed (ready to flow)
	    F Fuel Flowing

H	Handle (Handle value 1-8 for hose/grade 1-8)
EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits

RLM3
EXPLANATION OF COMMANDS

PPU Status Request Command — Z

Retrieves PPU change status for all fueling positions (up to 16)

Command

:XXZ<EOT><CS>

Response

:XXZxxxxxxxxxxxxxxxx<EOT><CS>

Representations in Command	
:	ASCII Colon
XX	Device Address — 2 ASCII digits in decimal (See Address Format in General Command Protocol)
Z	PPU Status Request Command

x	Status for each Fueling Position (1-16)
	        0=PPU has not changed since last P Command was issued
	        1=PPU has changed since last P Command was issued

EOT	EOT Character (0x04)
CS	Check Sum — 2's complement of all the characters starting with the ":" up to and including the EOT, masked off to 7 data bits