

Digital VP-2 Printer Software Specification

Revision 1.55 January 10, 2003



Redmer Controls Inc
180 Engelwood Dr.
Suite J
Lake Orion, MI. 48359
USA
Phone : (248) 373-9097
Fax: (248) 373-9089
www.redmer.com

(THIS PAGE INTENTIONALLY LEFT BLANK)

Contents


Hardware Specification	1
VP-2 Hardware Platform	1
The DVP-2 Controller	2
Requirements	2
Design Objectives	3
Controller PC	4
Controller PC	4
User Interface Hardware	5
Paper Advance Hardware	6
Digital I/O Hardware – Lenses, PPM, SSPM, Shutters & Senses	7
Optical Marker Accessory Hardware	8
Back-Writer Accessory Hardware	8
Stepping Paper Mask Accessory Hardware	8
Mullersohn LCD Subsystem	9
Additional RS-232 Serial Port Hardware	10
Printer Control System Sub-Panel	11
Software Specification	13
Operating System	13
Required Utilities And Drivers	13
Software Overview	14
Modes Of Operation	14
System Architecture	18
Main Screen – Printer & Print Server Status Display	19
Manual Print Mode & Print Selection	20
Hot Folder Processor & Image Render Engine	21
Product Catalog Subsystem: Split & Package Definitions	24
Paper Advance Subsystem	25
Digital I/O Subsystem	29
Serial Marker Subsystem	31
Stepping Paper Mask Subsystem	34
SSPM Subsystem	35
PPM Subsystem	36
LCD Subsystem	37
System Timing Subsystem	38
System Maintenance Subsystem	39
Database Management Subsystem & Registry Settings	40
Error Handling & Reporting Subsystem	42
White Space Fill Subsystem	44
Help Subsystem	45
Software Development Kit (SDK)	46

(THIS PAGE INTENTIONALLY LEFT BLANK)



Hardware Specification

VP-2 Hardware Platform

	<p>The VP-2 Printer.</p> <p>The main benefit of the VP-2 is its flexible design. With its interchangeable lens drawers, you can switch over to a different film format in a matter of minutes. The VP-2 is ideal for school and store promotion work, or any application where the film format is unlikely to change within any given order, but where different orders are in different formats.</p> <p>The VP-2 printer's flexibility and high performance have made it an industry standard. In fact, it's used in more school labs than any other printer on the market. It's also compatible with most automation systems.</p>
<p>Specifications</p> <p>Electrical: 117 VAC, 60/50 Hz, 20 amp Air supply: 80 psi at .25 cfm Weight: 650 lbs (29.2 kg) Height x Width x Depth: 71" x 50" x 26" (180.34 x 127 x 66 cm)</p>	<p>Features Standard & Optional</p> <p>Negative table 90° automatic rotation Paper sizes 5", 10" or 11" x 575' max * All sizes from 35mm to 70mm Print format Borderless/bordered Lamphouse Subtractive filter flags Stepper paper advance Lens drive assemblies: Daylight canister load Automatic roll film advance Stepper paper mask Mark paper with a single punch, package punch or marker bar</p>

The DVP-2 Controller

Requirements

Redmer Controls will design a completely new PC based printer controller for the DVP-2 providing the following features:

1. Control of Mullersohn LCD Array for “digital negative” rendering using Sony 8 Megapixel Array. The LCD subsystem will control calibration, color profile, rendering to LCD, the physical exposure and image shifting, LSB 3 Lamp house control and diagnostics.
2. Control of paper drive
3. Control of Lucht Optical Marker
4. Control of Lucht/Bremson Dual Back Writers
5. Control of Lucht Stepping Paper Mask (includes Motors & Senses)
6. Control of Lucht PPM (Includes Solenoids & Senses)
7. Control of Lucht SSPM (includes Solenoid & Senses)
8. Control of Lenses and related Lens Senses
9. Control of Rotary Table and related Senses
10. Control of Pan Shutter & related Senses
11. Control of IRIS Shutter & related Senses
12. Control of Paper-Out Sense
13. Control of Platen Sense
14. Control of Door-Open Sense
15. White-Space Fill based Image Rendering using standard Split and Package Definitions
16. Rendering of all standard image formats (see Appendix)
17. Support for input from Kodak DP-2, Express Digital, TimeStone, Axiohm, OZE, and other front-end applications using networked hot-folders similar to Fuji Frontier and Kodak LED printers
18. Support for input from Shooter Data Manager (SDM) using selectable (Invoice, Twin Check, or portion of Text field) for image tagging
19. Support for stand-alone manual digital image rendering and printing
20. Support for Touch-Screen operation

Design Objectives

Redmer Controls will design the new printer controller with the following objectives:

1. Utilize off-the-shelf hardware wherever possible
2. Design sub-panels, enclosures, and wiring for in-the-field installation. The control system will be self-contained.
3. Support legacy Lucht hardware wherever possible to reduce engineering expense and meet the target schedule of PMA '03.
4. Write the control application to support rendering on the printer or as networked print service to reduce processor requirements on the printer.

Controller PC

The Controller PC will be a standard “off-the-shelf” PC meeting the following requirements:

Brand	Dell Precision or Optiplex (http://www.dell.com or http://www.ibm.com) (Latest model or IBM brand equivalent to latest Dell model).
Processor	Intel Pentium 4 running at 2.5ghz (minimum)
Memory	512mb (minimum)
Storage	120gb IDE hard drive (minimum) 48x CD-Writer DVD Reader
Display	1024x768 resolution at 24-bit color depth (minimum)
LAN	100baseT or optionally 10/1000baseT Ethernet
O/S	Microsoft Windows 2000 Professional or XP Professional
Cost	\$2000 US as of January 1, 2003.

User Interface Hardware

The User Interface will consist of touch screen functionality for operation mode. A keyboard and mouse will also be available for configuration.

Brand	Signet Inc. (http://www.signetlcd.com)
Model	12" or 15" LCD Panel with Touch-Screen capability (4 wire resistive type) via RS-232 Serial Control. Video output to LCD panel using the PC primary video output (standard SVGA).

TFT Specifications

15.0" TFT LCD for Monitor	
6 bit RGB	
Active Area	304.1 * 228.1
Number of Pixels	1024 * RGB * 768
Pixel Pitch	0.0675 * 0.203
Number of Colors	262K
Contrast Ratio	200 to 1
Viewing Angle	50/-75, 75/-75
Brightness	200 nit
Power Consumption	16.5 W
Input Signal	TTL 2 Port
Supply Voltage	5V
Backlit	4 CCFL Replaceable
Dimension	350 * 266.6 * 17.2
Weight	1,500g

Paper Advance Hardware

The paper advance will be controlled via RS-232 serial protocol. The selected servo controller will provide highly accurate advance with self-contained real-time timers and output capabilities for precision placement and timing of optical markers, back-writers, and punches.

Brand	GE Fanuc (http://www.gefanuc.com)
Model	S2K Series Servo Controller model IC800SSI104D2-AD SL Series 400W AC Servo model IC800SLM040N1KE25A
Specifications	AC Input: 90-250 VAC 1 or 3 phase, 50-440Hz Operating Temperature: 0 to 50 C. Motor Speed: rated @ 3000 RPM, max @ 5000 RPM. Motor Torque: Peak @ 33.6in-lb. Motor Feedback: 2500 lines (10,000 counts/rev) Auxiliary I/O: 8 lines digital input, 6 lines digital output optically isolated, source/sink configurable (12-30V DC), 2 12-bit analog input & 1 8-bit analog output
Control	RS-232, 9600 baud, Odd Parity, 7 Data, 1 Stop

GEF S2K Specifications

GE Fanuc's S2K series servo amplifiers convert a torque, velocity, or pulse signal from an external controller to the proper current required to drive the servo motor. They offer improved high-speed performance, robust power blocks to eliminate overheating during motor stall, compatibility with microstepping resolutions, and reduced servo tuning requirements with self-tuning, all-digital drive. Compact design minimizes valuable panel space requirements.

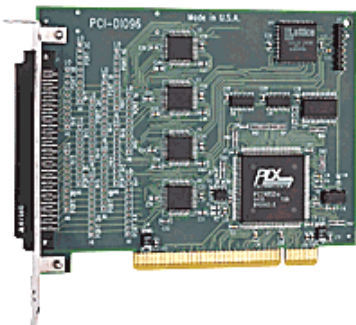

- Wide torque from 5.7-322 lb-in (0.64-36.3 Nm)
- Control either torque, velocity or position mode
- Comprehensive front panel diagnostics
- Auto tuning function.





Digital I/O Hardware – Lenses, PPM, SSPM, Shutters & Senses

The digital I/O subsystem will be used to control lens actuation, pan shutter, flaps, IRIS shutter, PPM & SSPM solenoids, and all digital sense lines. The selected I/O subsystem provides the capability of expanding the digital I/O in increments of 96 lines per PCI slot.

Brand	Measurement Computing Inc. (http://www.measurementcomputing.com)
Model	PCI-DIO96 connected to one SSR-RACK48 Solid State Relay Rack. An additional SSR-RACK48 may be incorporated at a later date if new accessories require more digital I/O.

PCI-DIO96	SSR-RACK48
<p>I/O bits: 96 Configuration: Four 82C55 chips (DIO96) **82C55 Specifications** I/O bits 24 divided into two 8-bit and two 4-bit ports. Each port can be set as input or output. Logic family: CMOS/TTL</p> 	<p>The SSR-RACK48 is a high density mounting and interface rack for use with quad type solid state relays. The SSR-RACK48 is the perfect means of interfacing quad solid state relays (SSR) modules to any 48, 96 or 192 line digital I/O board with 50 pin connectors.</p> <p>Providing positions for 12 quad relays, the SSR-RACK48 has screw terminals for each module. The screw terminals allow you to connect signals via 12-22 AWG wire. The signals are routed through the SSRs to the 50 pin, 48 line connector.</p> 

Outputs	Inputs
<p># of Outputs: 4 1500 Vrms isolation Load Voltage: 3 to 60 Load Current Max: 3.0 Amps Power Dissipation: 1W/Amp Blocking Voltage: 108 VDC Turn On Time: 50uS Turn Off Time: 100uS Off Leakage Current: 1.0 mA On Voltage Drop: 1.5VDC</p> 	<p># of Inputs: 4 1500 Vrms isolation Logic Supply Current: 10mA Voltage: 3.3 to 32 VDC Current (max): 32 mA Resistance: 1.0 Kohm Turn-on Time: 300 uS Turn-off Time: 600 uS Supply Current: 10 mA</p> 

Optical Marker Accessory Hardware

The printer will initially support the Lucht Optical Marker (Bar Marker M). It will communicate with the marker control board via RS-232 protocol. Redmer Controls is currently researching other LED options and potential re-design of the Marker Control Board to off-the-shelf micro-board.

Brand	Lucht (http://www.lucht.com)
Model	Bar Marker M
Control	RS-232, 9600 baud, No Parity, 8 Data, 1 Stop

Back-Writer Accessory Hardware

The printer will initially support the Lucht/Bremson Dual Impact Back Writers. It will communicate with the back writer control boards via RS-232 protocol. Redmer Controls is currently researching other options for the back writers including the Okidata-based system utilized by Hicks Equipment and various ink-jet based models.

Brand	Lucht (http://www.lucht.com)
Model	Dual Back Writers for Multi-printer
Control	RS-232, 9600 baud, No Parity, 8 Data, 1 Stop

Stepping Paper Mask Accessory Hardware

The printer will initially support the Lucht Stepping Paper Mask that contains two low-voltage stepper motors. It will communicate with the paper mask stepper controller (dual axis) via RS-232 protocol.

Brand	Lucht (http://www.lucht.com)
Model	Stepping Paper Mask
Control	RS-232, 9600 baud, No Parity, 8 Data, 1 Stop

Mullersohn LCD Subsystem

Specification T.B.D.: Includes LCD, Control System for LCD, Lucht LSB 3 Lamp house
+ Control System, Calibration & Diagnostic software.



Additional RS-232 Serial Port Hardware

The printer controller PC will come equipped with 1 or 2 serial ports, depending upon the model. The printer requires serial ports for the following accessories:

1. Touch screen
2. Paper Advance Controller
3. Stepping Paper Mask Controller
4. Optical Marker
5. Back Writer #1
6. Back Writer #2
7. Mullersohn LCD (possibly)

A USB to multi-port RS-232 adaptor will be used to accommodate the additional serial ports. These are available in 4 to 16 port versions.

Brand	Keyspan (http://www.keyspan.com)
Model	USB Serial Port Adaptor

The Keyspan USB 4-Port Serial Adapter allows 4 serial devices to be connected to a single USB port. It provides a simple way to add serial ports to a PC without the hassle of installing a serial card, turning off the PC, or configuring IRQs.

This adapter is ideal for industrial and enterprise markets where there is a need to connect serial device to a PC for process control, data collection, or point of sale applications. It is also ideal for connecting modems, fax modems, or terminals to a server.

- Plugs into a USB port on a PC
- Provides four RS-232 male DB9 ports for direct connection to serial devices
- Supports data rates up to 920 Kbps per port
- Draws its power from the USB connection -- a power adapter is not required



Printer Control System Sub-Panel

All printer-control hardware will be self-contained in a sub-panel enclosure that can be easily installed on any VP-2. Wiring from the enclosure to optional accessories will be easily accomplished with pre-fabricated harnesses.

Sample Panel Layout:

(Diagram/Picture)

(THIS PAGE INTENTIONALLY LEFT BLANK)

Software Specification

Operating System

The printer controller will operate on either of the following Operating Systems:

1. Microsoft Windows 2000 Professional
2. Microsoft Windows XP Professional

The software is not designed to execute on any other versions of the Microsoft Windows Operating Systems.

Required Utilities And Drivers

The printer is controlled by the following subsystems:

1. Digital I/O driven by Measurement Computing PCI-DIO96 using Universal Library Version 5.32 or higher.
2. Paper-Drive Servo Motion control by GEF S2K Controller via RS-232 (MS-COM).
3. ISA/Lucht Optical Marker controlled by RS-232 (MS-COM).
4. ISA/Lucht Dual Writer (Impact Printers) controlled by RS-232 (MS-COM).
5. Digital Render Engine controlled by Lead Technologies Multimedia Version 13.0 or higher.
6. Microsoft Excel® Compatible data entry provided by Farpoint Technologies Spread Control Version 6.0 or higher.
7. High-Precision machine timing provided by Mabry HiTime™ Version 2.0 or higher.
8. Software copy protection provided by SofPro PC Guard for Win32.

Software Overview

Modes Of Operation

The printer will support two modes of operation as it pertains to the network printing and the software packages that will feed the DVP2.

The first is to be a ‘dumb box’ printer where the outside vendors supply a pre-rendered image file to the printer that are passed along to the Mullersohn array for printing. The printer is simply an intermediary for the file in order to determine array rotation, lens selection, print quantities, identification, and punch information.

The second network printing method is for network software to provide an image file and the information associated with it. The printer will perform all rendering, white space fill determination, print ID, and graphic composition. In this scenario the printer will need to process the files using the following methods:

Control File Processing

Fuji, Kodak, and others use this method on the hardware side. It is also a standard output of Kodak DP-2, TimeStone, and other applications. Images are processed into the printer Hot Folders along with control information in ASCII text file format. The control files may be configured as “Order” files specifying multiple images or may identify single images. The printer software will process both types of files using pre-defined templates. The fields in the control files will be mapped to the printer’s database fields one-to-one using the “Control File Template Definition” feature.

Sample Control File from Kodak DVP-2

```
FILENAME: D:\2001x2576(8).tif
COPIES: 1
EOO: TRUE
CENTER: TRUE
RESOLUTION: RES10R
TONESCALE: FALSE
LUTFILENAME: D:\default12.prt
PAPFILENAME: D:\defaultPaperPak12Bit.pap
MULTIPUNCH: FALSE
BACKPRINTING: FALSE
DELETEFILE: TRUE
APPLY_LUT: TRUE
APPLY_PAP: TRUE
PAGE_ID: 79098664
```

Shooter System / ColorFlex File Processing

The printer software is designed around the standard VP-2 printer architecture with regard to lens configuration, paper masking, marking, and punch operation. The files that control printing in this scenario is fixed format ASCII files. The standard definition of the file is as follows:

The **Control Record**, Record 1, is 24 bytes long:

Bytes	Description/Field Name	Range of Values
00-03	Reserved	000-999
04-11	Reserved	0000-9999
12-17	Job Number/Production Number	000000-999999
18-23	Reserved	000000-999999

The **Package Definition Records**, Records 2-100, are 22 bytes long:

Bytes	Name	Description/Field Name	Range of Values
00-01	11x14	Size 1	00-99
02-03	8x10	Size 2	00-99
04-05	5x7	Size 3	00-99
06-07	3.5x5	Size 4	00-99
08-09	WALLT	Size 5	00-99
10-11	SUBWL	Size 6	00-99
12-13	SP-1	Split 1 or Size 7	00-99
14-15	SP-2	Split 2 or Size 8	00-99
16-17	SP-3	Split 3 or Size 9	00-99
18-19	SP-4	Split 4 or Size 10	00-99
20-21	SP-5	Split 5	00-99

The **Frame Records**, Records 100-1099, are 92 bytes long:

Bytes	Name	Description/Field Name	Range of Values
00-01	Pkg	Package Number, may also contain BL for blink, SL for slate, NP for No Package.	00-99, BL, SL, NP
02	Prnt	Print Code: N for Not printed, P for printed, T for printed Twice	N, P, or T
03	Rep	Reprint Reason Code: D for dirt, C for color, Q for quantity, Y for Y centering	D, C, Q, or Y
04-05	CD	Density factor	-9,+9
06-07	Y	Y Axis	-9,+9
08-09	CR	Red correction	-9,+9
10-11	CG	Green correction	-9,+9
12-13	CB	Blue correction	-9,+9
14-16	VD	Video Density	000-199
17-18	VR	Video Red	00-99
19-20	VG	Video Green	00-99
21-22	VB	Video Blue	00-99
23-24	11x14	Alacarte Size 1 / Multipackage 2	00-99

25-26	8x10	Alacarte Size 2 / Multipackage 3	00-99
27-28	5x7	Alacarte Size 3 / Multipackage 4	00-99
29-30	3.5x5	Alacarte Size 4 / Multipackage 5	00-99
31-32	WALLT	Alacarte Size 5 / Multipackage 6	00-99
33-34	SUBWL	Alacarte Size 6 / Multipackage 7	00-99
35-36	SP-1	Alacarte Size 7 / Split 1 / Multipackage 8	00-99
37-38	SP-2	Alacarte Size 8 / Split 2 / Multipackage 9	00-99
39-40	SP-3	Alacarte Size 9 / Split 3 / Multipackage 10	00-99
41-42	SP-4	Alacarte Size 10 / Split 4 / Multipackage 11	00-99
43-48	Invoice	Invoice/Order Number	000000-999999
49-54	TwinCheck	Twin check, Roll, Sitting, or Camera Card Number	000000-999999
55-57	Frm#	Frame Number	000-999
58	FilmT	Film Type	1-6
59	Rotat	Rotation of Deck	Y/N, 1-7, A-G
60-89		Name / Text Field	30 characters alpha-numeric

All characters are US ASCII 8 bit format.

Each record is terminated with carriage-return/line feed pair (CR/LF) ASCII 13 ASCII 10.

The file size is 94,310 bytes; some systems may recognize a variable-length file where the actual number of frame records is less than the fixed 999 records.

Shooter System Data Entry (Shooter Data Manager Subsystem)

The printer will provide a subset of the Shooter Data Manager (SDM) application for on-the-fly data modification and simple order creation at the printer console. The SDM features included in the printer are:

1. File editing (Open, Save, Save As, Edit Window)
2. Find/Replace

The following screen capture depicts the SDM-style editing window.

SDM

File Edit Window Help

Untitled 1

File Info

Pacer	Pacer Size	Slate	Mode	Job#	Control#
00	00	00	00	000000	000000

Packages

	11x14	8x10	5x7	3.5x5	WALLT	SUBWL	SP-1	SP-2	SP-3	SP-4	SP-5
1	00	00	00	00	00	00	00	00	00	00	00
2	00	00	00	00	00	00	00	00	00	00	00
3	00	00	00	00	00	00	00	00	00	00	00
4	00	00	00	00	00	00	00	00	00	00	00
5	00	00	00	00	00	00	00	00	00	00	00
6	00	00	00	00	00	00	00	00	00	00	00
7	00	00	00	00	00	00	00	00	00	00	00

Exposures

	Pkq	Pmt	Rep	Y	CD	CR	CG	CB	VD	VR	VG	VB	11x14	8x10	5x7	3.5x5
6	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
7	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
8	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
9	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
10	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
11	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
12	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
13	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
14	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
15	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
16	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
17	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
18	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
19	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
20	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
21	00	N	D	0	0	0	0	0	000	00	00	00	00	00	00	00
??	nn	N	n	n	n	n	n	n	nnn	nn	nn	nn	nn	nn	nn	nn

Image Linking

Images may be linked to the SDM data file using the Invoice#, Twin Check#, or any contiguous portion of the Text field. The printer will provide a “SDM File Template” feature to define how images are linked.

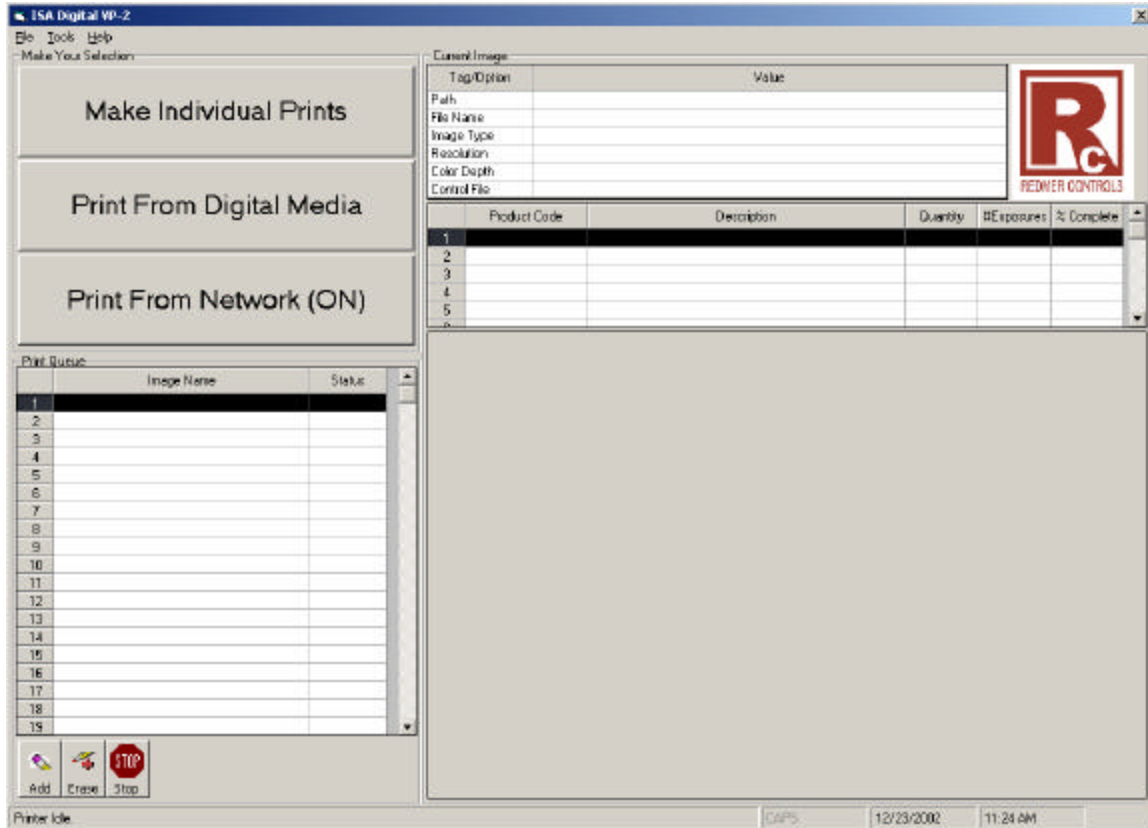
System Architecture

The printer controller software will be written in Microsoft Visual Basic version 6.0 (or higher). The software consists of the following sub-systems:

1. Main Screen – Printer & Print Server Status Display
2. Manual Print Mode & Print Selection
3. Hot Folder Processor & Image Render Engine
4. Product Catalog Subsystem: Split & Package Definitions
5. Paper Advance Subsystem
6. Digital I/O Subsystem
7. Serial Marker Subsystem (Optical & Back Writer)
8. Stepping Paper Mask Subsystem
9. SSPM Subsystem
10. PPM Subsystem
11. LCD Subsystem
12. System Timing Subsystem
13. System Maintenance Subsystem
14. Database Management Subsystem & Registry Settings
15. Error Handling & Reporting Subsystem
16. White Space Fill Subsystem
17. Help Subsystem
18. Software Development Kit (SDK)

Main Screen – Printer & Print Server Status Display

The main screen provides the Main Menu, user selections for mode of operation, printer queue status, and status of the current image.



User Selections:

1. **Make Individual Prints:** This option is used to manually select and print images.
2. **Print Images from Digital Media:** This option is used to print one or more images from CD-ROM, DVD, or other digital media using manual print selection.
3. **Print From Network (ON/OFF):** This option is used to put the printer in Auto-Print Mode for network printing (i.e. print server).

Manual Print Mode & Print Selection

Hot Folder Processor & Image Render Engine

The printer requires two types of folders for rendering images:

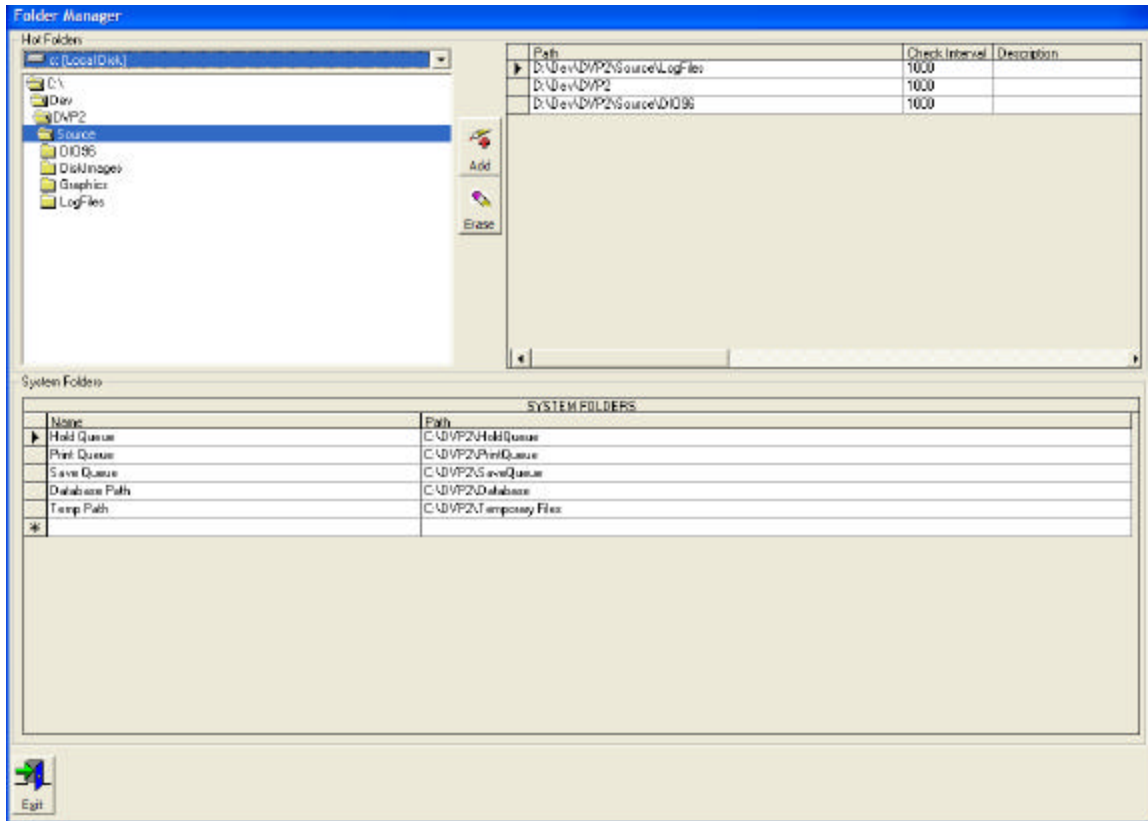
1. Hot Folders are physical storage locations that the printer will check on the specified time interval for image and control files. The system administrator may assign one or more Hot Folders by simply using the folder chooser to select a location and pressing the “Add” button. Hot Folders may be removed by pressing the “Erase” button.
2. System Folders are physical storage locations that the printer uses to process and manage batches of images during the print cycle. The names of these folders are fixed and cannot be changed by the user. However, the folder path can be re-assigned in the event the physical storage capacity on the printer is increased in future with additional storage devices.

System Folders

The system folders are used as follows:

1. The Hold Queue is used to store unprocessed images and control files for batch rendering at a later time. This feature is useful in situations where the printer is loaded with images to print and is off-line for paper change or maintenance.
2. The Print Queue is the current working queue. Each image in the print queue is rendered and staged for printing.
3. The Save Queue is used to render images for later printer. This feature is useful to batch render images intended for the next roll of paper. It is also useful to create a working set of composed images (white space fill) requiring additional or special handling prior to printing.
4. The Database Path provides the physical storage location for the application database. This feature provides the ability to move the database if required.
5. The Temp path simply provides a storage location for temporary files that are created during the image render process. This feature is useful in cases where the temporary folders are centrally managed.

The folder manager window is shown below:



Window Controls:

- The drive and folder selection controls provide the ability to navigate all accessible disk drives and directories (folders) on the printer PC. This includes drives and folders mapped from a local area network (LAN), CD-ROM, DVD, etc.
- The Hot Folder and System folder spreadsheet grids are bound the application database, which is automatically updated upon exiting the window. There is no limit on the number of Hot Folders and System Folders that may be utilized. However, there is a practical limit on the number of Hot Folders in terms of the Check Interval. Assigning a large number of Hot Folders with a low Check Interval will consume system resources and impede performance. A practical limit of 10 Hot Folders on 1-second intervals should be adhered to.
- The Exit button simply hides the window and returns control to the main application window.

Image Render Engine

The purpose of the Image Render Engine is to process images into a functional Print Queue from the Hot Folders using Print Order information from one of the following sources:

1. Control Files created by networked applications such as DP-2, Timestone, etc.
2. The Manual Print Mode/Print Selection feature of the printer.
3. Shooter Data Manager (SDM) Files with image-tagged field assignment.

(Insert Block Diagram, Flow-Chart, and Pseudo-Code here)

Product Catalog Subsystem: Split & Package Definitions

Paper Advance Subsystem

The paper advance is controlled by the GE Fanuc S2K Motion Controller, which communicates with the printer controller via RS-232 port. The Paper Advance Maintenance window provides functions for configuring and troubleshooting the motion control system. The printer will not function without an operational paper advance and there is no override for this subsystem.

All of the functions are provided in a tab control organized by simple advance settings (advance lengths) and Advanced Motor Control Settings for initial configuration and troubleshooting. The serial communication command history is provided in a scrollable text-box. The history can be saved to ASCII format text files for remote troubleshooting if necessary.

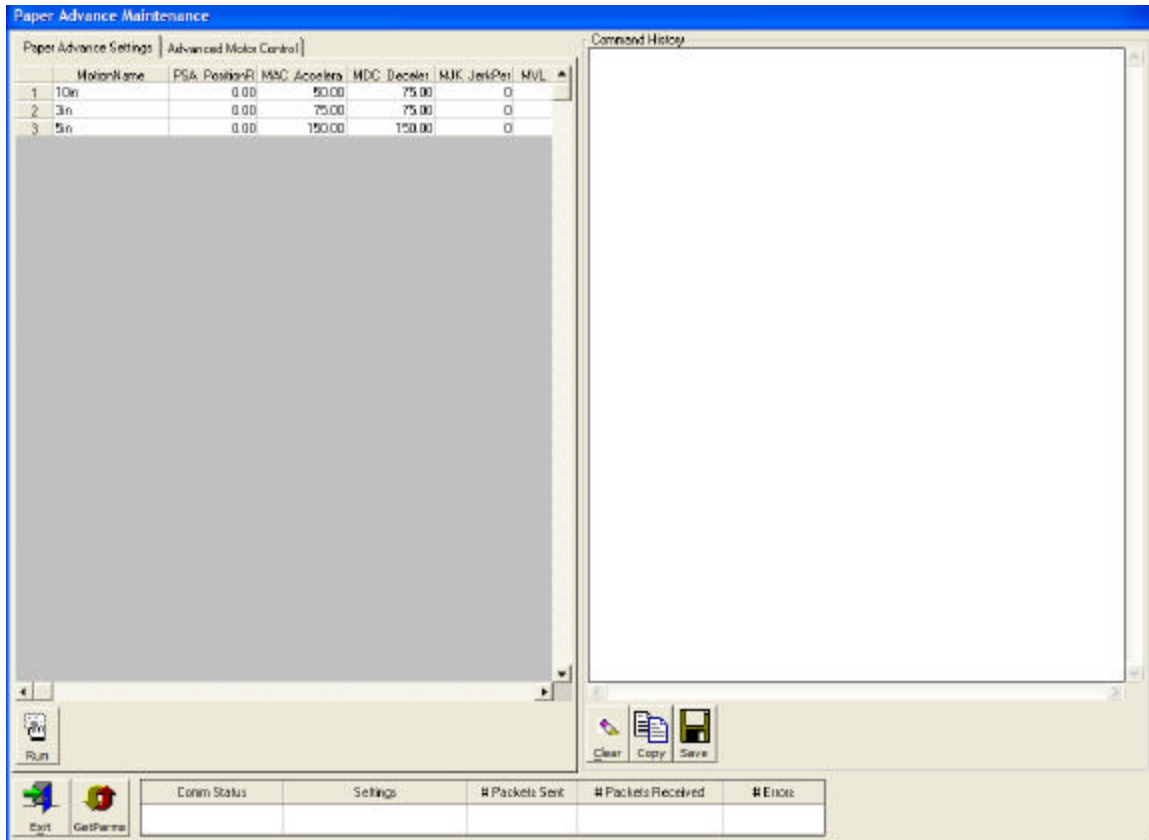
The communication port status and settings are also displayed at the bottom of window. This status shows the port# and number of packet errors for troubleshooting the hardware.

Paper Advance Settings

The Paper Advance Settings tab provides a spreadsheet grid control for configuring each of the fixed advance lengths required by the printer. The configurable variables of each advance are:

1. Advance Name – specifies a name for the advance used in Unit definition.
2. PSA – The absolute position register for the controller. This is normally zero (0).
3. MAC – The acceleration in units/sec.
4. MDC – The deceleration in units/sec.
5. MJK – The Motion Jerk Percentage smoothes the acceleration and deceleration ramps to provide high-speed performance without tearing the paper.
6. MVL – The Motion Velocity specifies the maximum velocity in units/sec for the advance.
7. MVA – The Absolute distance to move for the advance in units (Inches or Millimeters)

The Paper Advance Settings tab is shown below:



The Paper Advance Settings tab contains a “Run” button to test the advance currently selected in the spreadsheet grid.

The “Get Parameters” button is used to retrieve the motion controller parameters (type, software revision number, etc.)

The “Exit” button simply hides the window and returns control to the main window.

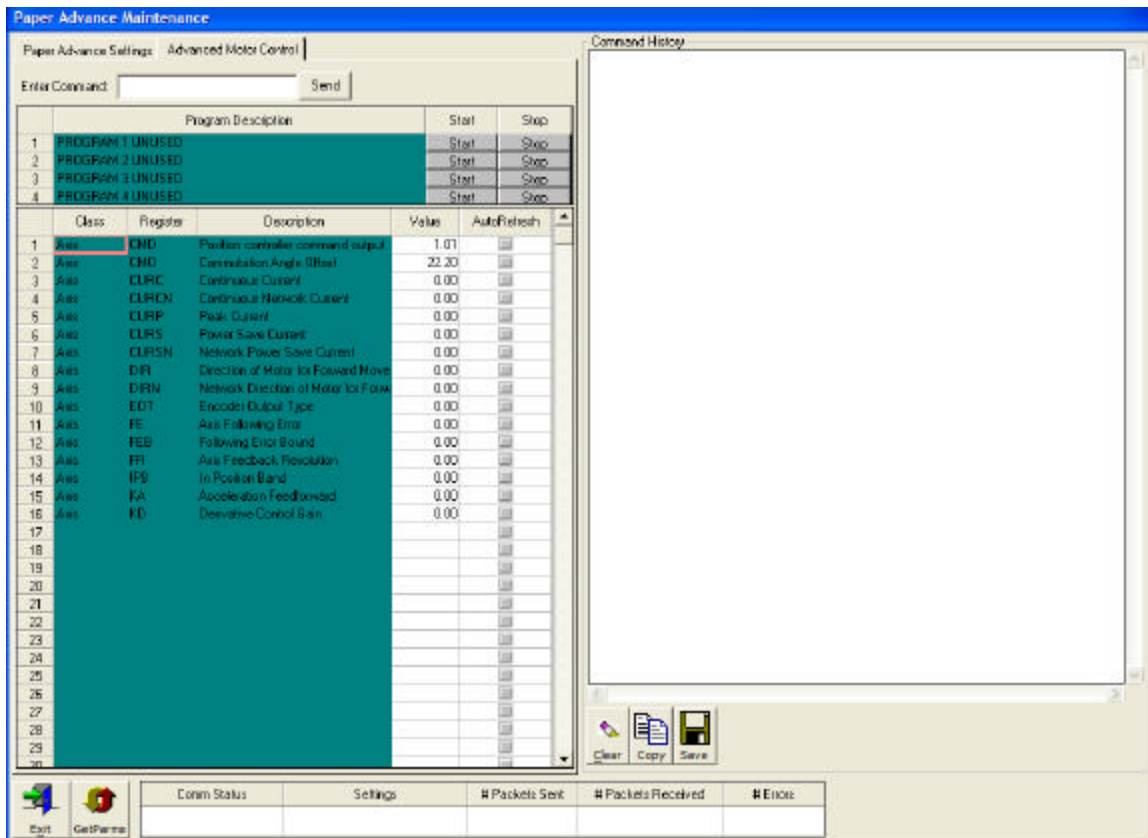
Advanced Motor Control

This tab is used to configure the motor parameters during installation and for troubleshooting problems if necessary. It provides a Command Text field to enter and execute a Motion Control (Specified by the GEF S2K Command Language).

The “Program” spreadsheet grid provides the ability to start and stop stored programs on the motion controller. The initial release of the printer controller does not utilize this feature of the servo controller in any user-accessible way (i.e. the programs are for internal use only). Future releases may utilize stored programs to increase speed and accuracy of printer accessories.

The “Register” spreadsheet grid provides access to the GEF S2K internal registers. These registers are configured during machine setup to optimize performance and accuracy of the motor.

The Advanced Motor Control window is shown below:



Paper Advance Standard Motion Protocol

The sequence of commands required to move the motor are as follows:

Command Sequence	Description
KLALL TMR1? RSF ** Send Parameters PARM=value RPA WAIT IP TMR1? PSA=0	Stop all running programs on servo Echo Timer to PC (Precision time of start) Reset Faults (if any are set) Send each advance parameter Run motor to absolute position Wait until motor In Position Echo Timer to PC (Precision time of end) Clear absolute position register

NOTE: Per S2K convention, each of the commands is prefixed with "1" and terminated with ASCII Carriage-return/Linefeed.

Paper Advance Get Parameters Protocol

The motion control parameters returned by the Get Parameter function are:

"IREVISION"	S2K Firmware Revision # and Date
"1BAUD?"	Firmware Communications Baudrate
"1BIT?"	Firmware Communications Data Bits
"1PAR?"	Firmware Communications Parity

Paper Advance Serial Port Timeout Timer

The paper advance serial port is accessed using the Microsoft MS-COM Control (mscomm32.ocx) and monitored using a standard Microsoft Windows (55ms precision) Timer Control. The timer interval is set to 500ms and is only active while expecting a response from the controller. If the response is not received within three timer intervals (1.5sec) the program will record an error and retry the command. The Retry limit is fixed at 10 at which point a machine fault will occur.

Paper Advance Serial Error Handling

The following serial port errors are processed and recorded:

comEventBreak	'A Break was received.
comEventFrame	'Framing Error
comEventOverrun	'Data Lost
comEventRxOver	'Receive buffer overflow
comEventRxParity	'Parity Error
comEventTxFull	'Transmit buffer full
comEventDCB	'Unexpected error retrieving DCB

The following serial port errors are not defined (not physically wired):

comEvCD	'Change in the CD line
comEvCTS	'Change in the CTS line
comEvDSR	'Change in the DSR line
comEvRing	'Change in the Ring Indicator

Inter-message Timing

The Paper Advance Packet Send function uses the application high-precision timer to ensure a 10ms delay between packets sent to the S2K controller.

Digital I/O Subsystem

The Digital I/O Subsystem provides control of all solid-state and electro-mechanical relays (outputs) and monitoring of senses and switches (inputs). The hardware control is provided by the Measurement Computing Universal Library Dynamic Link Library (cbw32.dll), which drives the PCI-DIO96 board. The PCI-DIO96 board is connected to two SSR-RACK48 boards having 12 quad input or output modules. One board is configured for output and the other for input. Thus the DVP-2 comes standard with 48 inputs and 48 outputs.

The Digital I/O subsystem is accessed on the Digital I/O Maintenance window. The window is divided in half – one for Outputs and the other for Inputs.

Digital Outputs

The digital outputs are listed in a spreadsheet grid control. The areas shaded in green are locked to user input. The only option available for digital output is the ON/OFF button. When the output is ON, the Red LED on the corresponding output module will also turn ON. If the output drives a mechanical component of the printer into a sensor, such as a lens level, the corresponding input for the sense will also turn ON (if Enabled).

Digital Inputs

The digital inputs are also listed in a spreadsheet grid control. The inputs have user-definable timeouts and may be disabled if necessary. The printer controller monitors inputs using a standard Microsoft Windows (55ms) Timer. Thus the actual precision for timeouts is +/- 55ms.

The only window-level option available is “Exit”, which will return control to the main window.

The Digital I/O Maintenance Window is shown below:

Measurement Computing API Calls

Call	Description
CbDeclareRevision	Opens and declares revision of library
CbDConfigPort	Configures ports as input or output
CbDBitIn	Retrieves status of input bit
CbDBitOut	Sets output bit

The Digital I/O Maintenance window is shown below:

Digital I/O Maintenance									
Outputs					Inputs				
Port	Bit	Description	On/Off		Port	Bit	Description	TimeOut(ms)	Enabled
0	0	Lens Level 1	<input type="checkbox"/>		0	0	Lens Level 1	500	<input type="checkbox"/>
0	1	Lens Level 2	<input type="checkbox"/>		0	1	Lens Level 2	500	<input type="checkbox"/>
0	2	Lens Level 3	<input type="checkbox"/>		0	2	Lens Level 3	500	<input type="checkbox"/>
0	3	Lens Level 4	<input type="checkbox"/>		0	3	Lens Level 4	500	<input type="checkbox"/>
0	4	Lens Level 5	<input type="checkbox"/>		0	4	Lens Level 5	500	<input type="checkbox"/>
0	5	Lens Level 6	<input type="checkbox"/>		0	5	Lens Level 6	500	<input type="checkbox"/>
0	6	Pan Shutter	<input type="checkbox"/>		0	6	Pan Shutter	500	<input type="checkbox"/>
0	7	Table Rotate	<input type="checkbox"/>		0	7	Is Shutter Open	500	<input type="checkbox"/>
1	0	Is Shutter	<input type="checkbox"/>		1	0	OPEN	500	<input type="checkbox"/>
1	1	Left Rip	<input type="checkbox"/>		1	1	Paper Cabinet Door Closed	500	<input type="checkbox"/>
1	2	Right Rip	<input type="checkbox"/>		1	2	Platen Engaged	500	<input type="checkbox"/>
1	3	SSPM Punch	<input type="checkbox"/>		1	3	Paper Bulk	500	<input type="checkbox"/>
1	4	OPEN	<input type="checkbox"/>		1	4			<input type="checkbox"/>
1	5	OPEN	<input type="checkbox"/>		1	5			<input type="checkbox"/>
1	6	OPEN	<input type="checkbox"/>		1	6			<input type="checkbox"/>
1	7	OPEN	<input type="checkbox"/>		1	7			<input type="checkbox"/>
2	0	PPM Punch BA1	<input type="checkbox"/>		2	0			<input type="checkbox"/>
2	1	PPM Punch BA2	<input type="checkbox"/>		2	1			<input type="checkbox"/>
2	2	PPM Punch BA3	<input type="checkbox"/>		2	2			<input type="checkbox"/>
2	3	PPM Punch BA4	<input type="checkbox"/>		2	3			<input type="checkbox"/>
2	4	PPM Punch BA5	<input type="checkbox"/>		2	4			<input type="checkbox"/>
2	5	PPM Punch BA6	<input type="checkbox"/>		2	5			<input type="checkbox"/>
2	6	PPM Punch BA7	<input type="checkbox"/>		2	6			<input type="checkbox"/>
2	7	PPM Punch BA8	<input type="checkbox"/>		2	7			<input type="checkbox"/>
3	0	PPM Punch	<input type="checkbox"/>		3	0			<input type="checkbox"/>
3	1		<input type="checkbox"/>		3	1			<input type="checkbox"/>
3	2		<input type="checkbox"/>		3	2			<input type="checkbox"/>
3	3		<input type="checkbox"/>		3	3			<input type="checkbox"/>
3	4		<input type="checkbox"/>		3	4			<input type="checkbox"/>
3	5		<input type="checkbox"/>		3	5			<input type="checkbox"/>
3	6		<input type="checkbox"/>		3	6			<input type="checkbox"/>
3	7		<input type="checkbox"/>		3	7			<input type="checkbox"/>
4	0		<input type="checkbox"/>		4	0			<input type="checkbox"/>
4	1		<input type="checkbox"/>		4	1			<input type="checkbox"/>
4	2		<input type="checkbox"/>		4	2			<input type="checkbox"/>
4	3		<input type="checkbox"/>		4	3			<input type="checkbox"/>
4	4		<input type="checkbox"/>		4	4			<input type="checkbox"/>
4	5		<input type="checkbox"/>		4	5			<input type="checkbox"/>

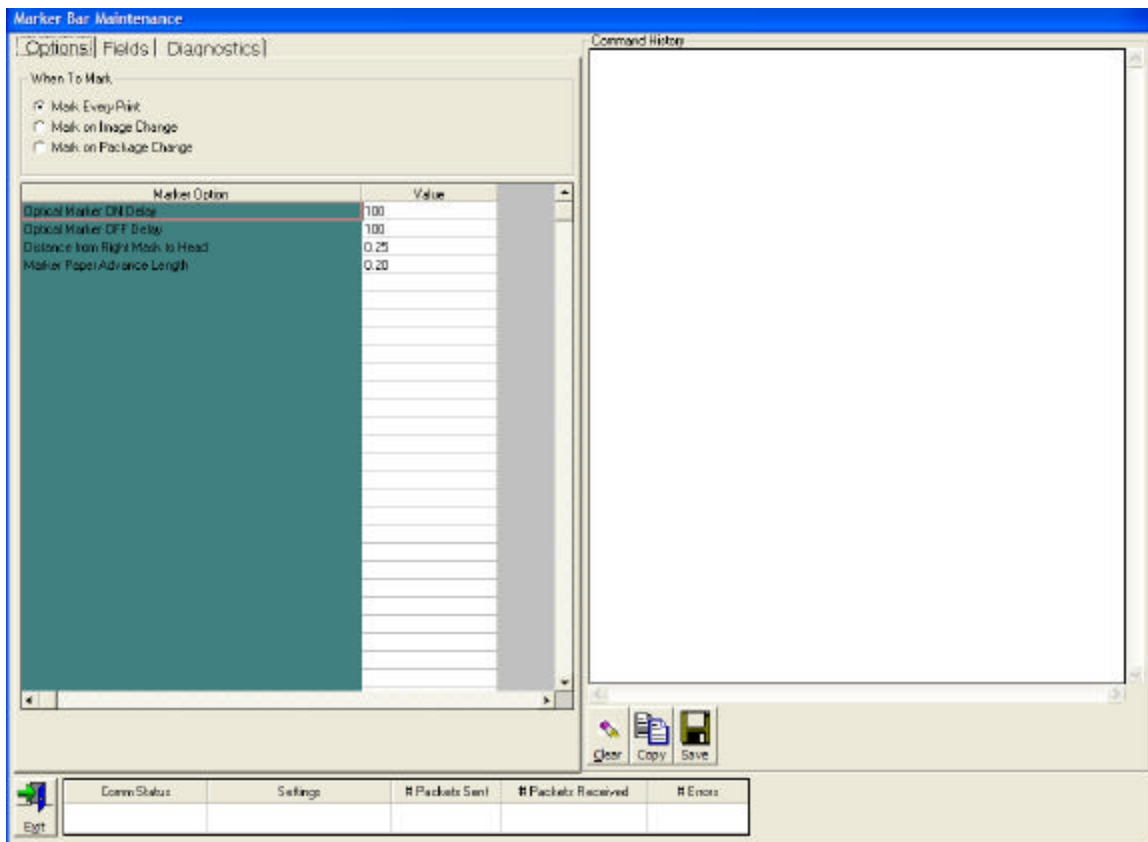
Serial Marker Subsystem

The printer controller communicates with the Serial Markers such as Lucht LED Marker Bar, and Dual Back Writers using RS-232 protocol. The Marker Maintenance window provides access to marker configuration and diagnostics. All of the functions are provided in a tab control organized by Options, Fields, and Diagnostics for troubleshooting. The overall maintenance functions for each marker are identical. Marker specific options are listed in the “Options” tab on the maintenance window. The serial communication command history is provided in a scrollable text-box. The history can be saved to ASCII format text files for remote troubleshooting if necessary.

The communication port status and settings are also displayed at the bottom of window. This status shows the port# and number of packet errors for troubleshooting the hardware.

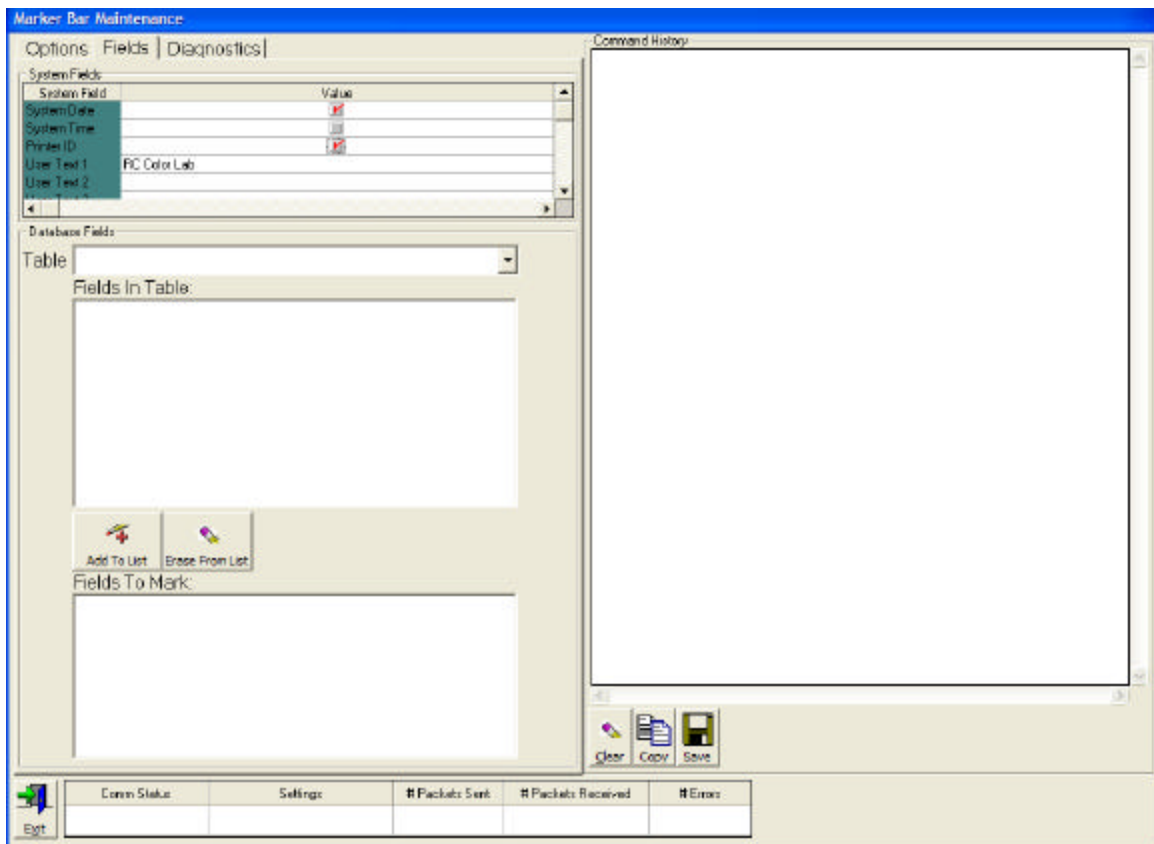
Marker Options

Marker options consist of specifying when to mark and marker-specific options such as timing, advance lengths, size of text, etc. The Marker Options will vary depending upon the type of marker selected.



Marker Fields

The Fields tab provides the ability to select which information to mark from a set of System fields and from the database. System fields will always print prior to database fields. Database fields provide for dynamic printing of text from the production database. This feature is useful for marking order number, invoice number, customer name, image identification, etc. The database field order is user-definable.



Marker Diagnostics

The Marker Diagnostics tab provides the ability to mark plain text or barcode text if supported by the marker hardware. Simply enter the text to send, and then press the “Send” button. The barcode style is selectable.

The screenshot shows the 'Marker Bar Maintenance' application window. The 'Diagnostics' tab is selected, showing options for sending text or barcode data to a marker. The 'Text To Mark' field contains 'Test Text' and the 'Barcode To Mark' field contains '123456'. The 'Code 3 of 9 (Code 39)' option is selected for the barcode style. A 'Command History' window is open on the right. The bottom status bar shows 'Conn Status', 'Settings', and counts for '# Packets Sent', '# Packets Received', and '# Errors'.

Conn Status	Settings	# Packets Sent	# Packets Received	# Errors

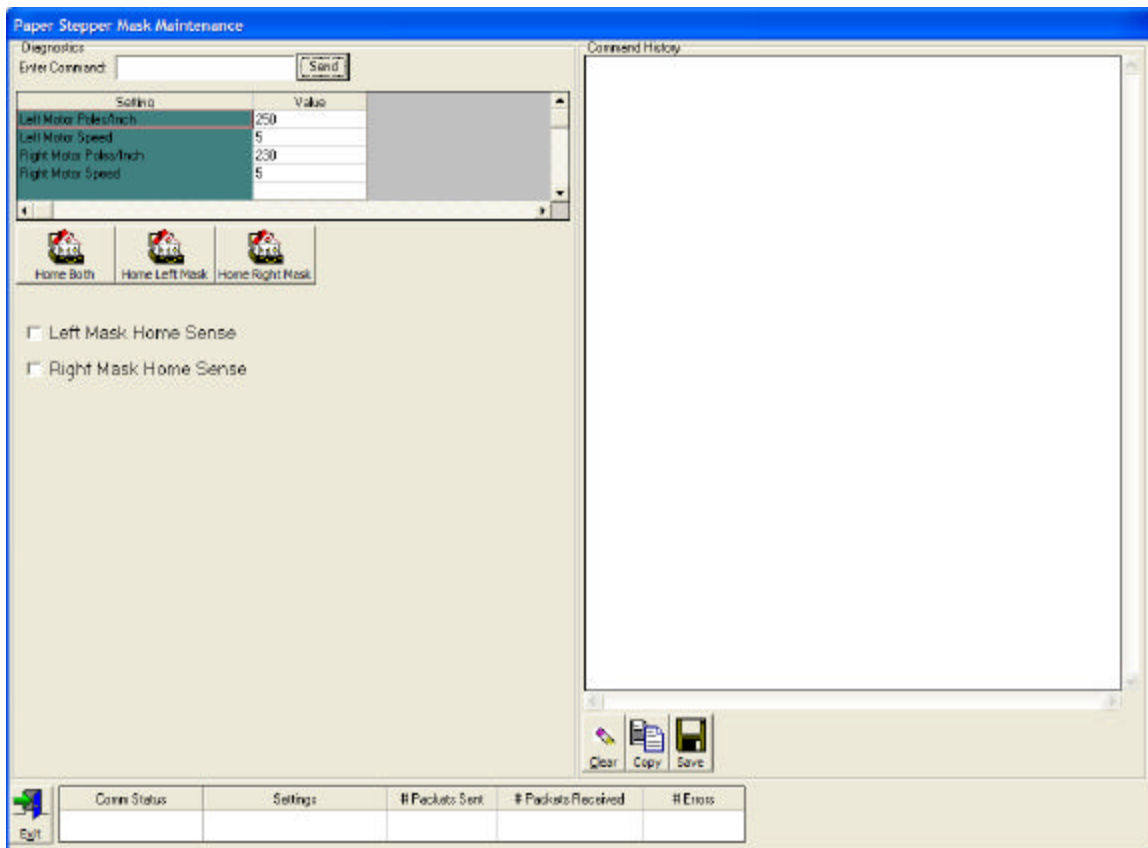
Stepping Paper Mask Subsystem

The printer controller communicates with the Stepping Paper Mask using RS-232 protocol. The Stepping Paper Mask Maintenance window provides access to configuration and diagnostics.

The serial communication command history is provided in a scrollable text-box. The history can be saved to ASCII format text files for remote troubleshooting if necessary.

The communication port status and settings are also displayed at the bottom of window. This status shows the port# and number of packet errors for troubleshooting the hardware.

The only options available for the paper mask are Poles/Inc setting, speed, Command Text, and command buttons.



SSPM Subsystem

PPM Subsystem

LCD Subsystem

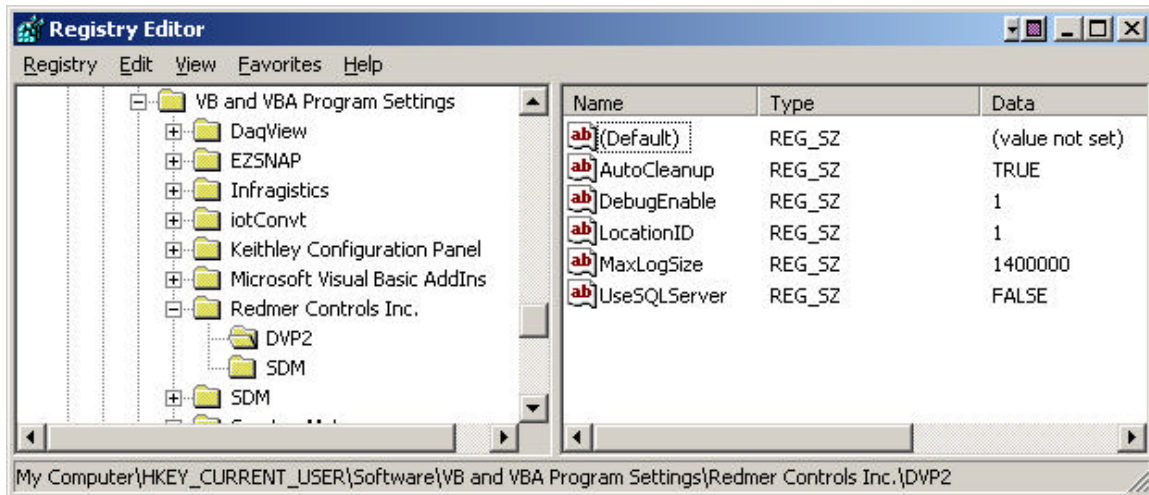
System Timing Subsystem

System Maintenance Subsystem

Database Management Subsystem & Registry Settings

Registry Settings

The printer software will automatically update the Microsoft Windows Registry upon first startup with the following keys/values:



The keys are defined as:

Key Name	Data Range	Description
AutoCleanup	TRUE/FALSE	Set TRUE to enable automatic cleanup of printer log files
DebugEnable	0-5	Set to greater than 0 for Debug Level (0=off)
LocationID	0-999999	Set to physical machine ID of printer
MaxLogFileSize	0-9999999999	Set to maximum size of individual log file
UseSQLServer	TRUE/FALSE	Set TRUE to use SQL Server instead of Access database

Database Configuration

The printer will store all information in Microsoft Access 2000® database format (.MDB) file. The printer software contains native drivers for Microsoft Access. Therefore a Microsoft Access license will not be required.

The name of the database file is: DVP2.MDB

When the printer application is running it will create a database lock-file to enable multi-user access. The name of the lock file is: DVP2.LCK

The table structure of the database is as follows:

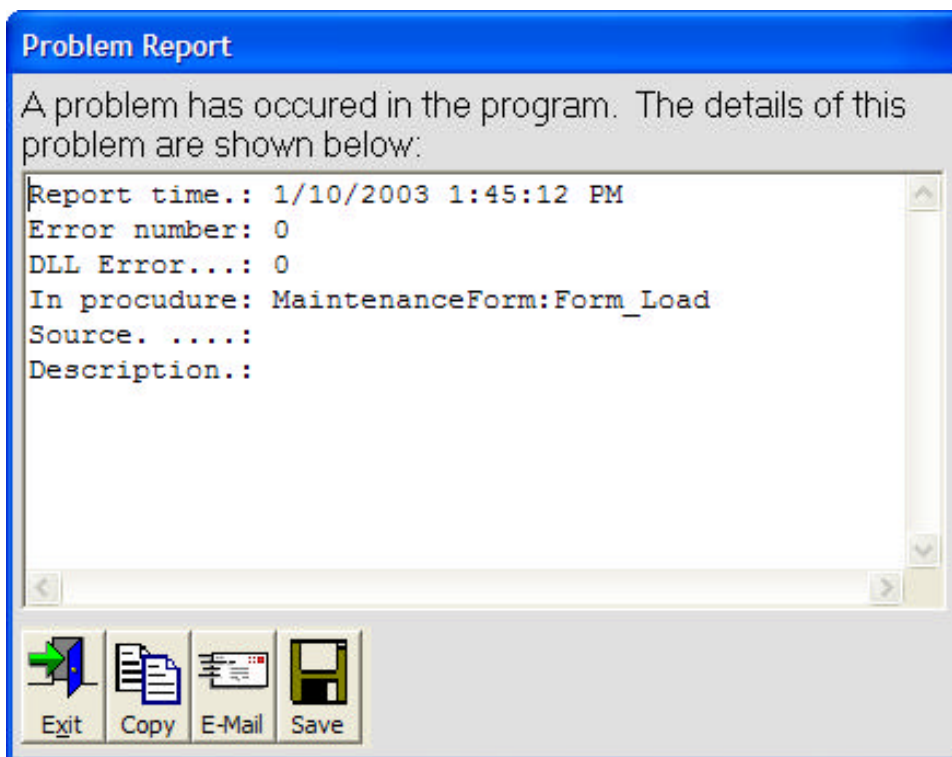
Error Handling & Reporting Subsystem

Error Handling

The printer error handler is designed to provide a consistent reporting of all critical errors encountered while in production. The error handler provides three functions for retaining and communicating errors as they occur:

1. Copy. This simply copies the error message to the Microsoft Windows Clipboard. Once the message is in the clipboard it can be pasted into documents or electronic mail for reporting.
2. E-Mail. If an electronic mail (e-mail) account is configured on the printer this function may be used to automatically e-mail the error text.
3. Save. This simply saves the file to disk in ASCII Text format.

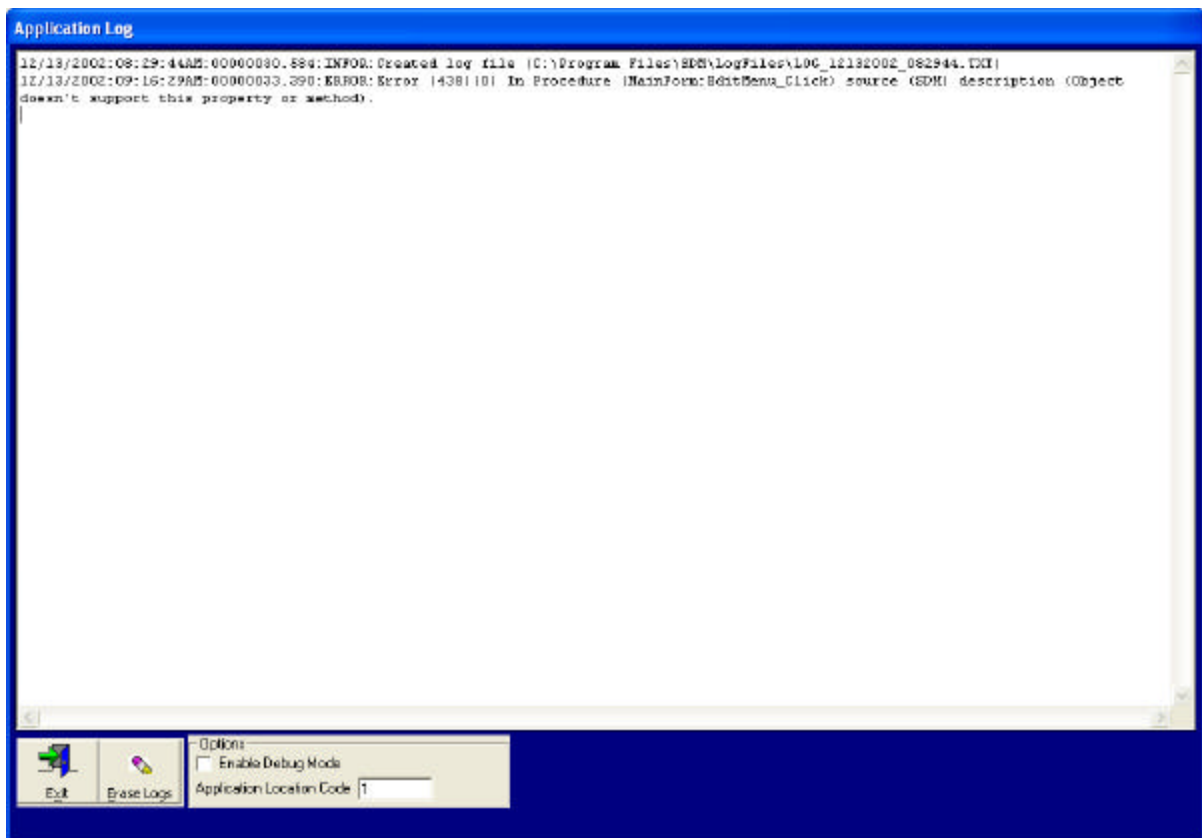
A sample of the error window is shown below:



View Application Log File

The application log file window lists informational, debug, and error messages that are stamped by date and time, and listed chronologically. Messages cannot be deleted individually, but only as a complete batch. Debug Mode can be enabled for diagnostic purposes. The application log file is created each time the printer software is executed. The maximum log file size is programmable using the Windows Registry (See Registry section). The log files are automatically deleted periodically by the printer application when the “AutoCleanup” registry setting is set to TRUE.

A sample of the Application Log Window is shown below:



White Space Fill Subsystem

Help Subsystem

Help Index

Help About

The Help About window simply displays the software version and copyright information.



Software Development Kit (SDK)

The printer controller will feature a Software Developer Kit that will spell out the interface methods as well as details on how to send rendered files.