CS102 Spreader Control Manual CS102M1A

General Description

The CS102 implements a digital rate control for granular and liquid systems typically used to regulate snow and ice highway spreading equipment. The CS102 is a full featured granular control for the spreader systems using conventional conveyor & spinner. The CS102 will also operate an auxiliary liquid pump for pre-wet applications. The CS102 can alternately be configured to operate a de-icing system by connecting the conveyor valve drive to a large volume liquid pump. The CS102 uses advanced digital techniques to regulate the shaft speed of the conveyor in direct response to vehicle speed. The granular spread rate is calibrated and regulated in true units of "pounds per mile". The pre-wet control is calibrated for "gallons per ton" and the De-ice control is calibrated for "gallons per mile". The CS102 accommodates both closed loop and open loop control with calibrations for ground speed input and shaft driven pulse sensor feedback.

Features:

> Automatic ground speed and manual modes for rate control
> Blast and Pass (remote switch spot mode)
> Controls both drag chain conveyor or auger (screw) type spreaders
> Four pre-set spinner output settings, detent switch
> Eight different granular materials, with individual data logging
> Granular control, 20 to 3000 pounds/mile, open loop or closed loop shaft control
> Liquid pre-wet control, 0.5 gal/ton to 12 gal/ton, open or closed loop shaft control
> De-ice control, 250 gal/mile, open or closed loop rate control
> Electronic or mechanical transmission sensor interface (mph)
> PWM closed loop current control or open loop voltage control
> Digital switch input for gearbox or spot spreading options
> Dual time based data logging; spreader miles, total material output (pounds) per product
> Supports field printing and PC interface, RS232 interface
> Supervisory: spread rate limits, manual lockout, spot/pass, Blast, material types
> Software upgrade via field lap top
> English or metric operation
> 10 year real time clock

The CS102 employs a PWM current control for precise open loop shaft control. The CS102 calculates and displays the spread rate and accumulated pounds delivered. The spinner and conveyor automatically start and stop with the vehicle. The digital controller has complete system surveillance with alarm indication for conveyor overrun, failed valve coils, cables and sensor functionality. This compact design is easily adapted to most console/cab layouts. The operator benefits from the large format numeric display with easy to use feed rate and lane width controls.

Field Printer (option)

The CS102 incorporates a standard RS232 communications port for use with remote communications devices. Using the optional field printer p/n FP100 allows you to extract the internal. The print-out includes accumulated totals for both recent and annual usage's, total pounds of material for all eight granular product types, total gallons of liquid, total miles in auto and manual, calibrations, dates and times. Simply connect the printer to the comm. port, turn power ON to the CS102 to print a short menu. Use the Rate knob to select the menu item number. Press Blast to print. When the printing is completed turn the power switch OFF and remove the printer connection.

Operational features

The CS102 has a **manual** mode that gives the operator direct electro-hydraulic control over the conveyor and spinner valves. Manual mode is useful for testing the basic hydraulic system and as backup operation should a sensor fail. Manual mode does not conserve spreading material and does not automatically shut off the feed rate when the vehicle comes to a stop. In manual the display still shows lbs./mile but as the vehicle moves, this number will move up and down since there is no ground speed regulation.

Blast will instantly output 100% and normally is used to lay down a thick coverage of material. Alternately, Pass instantly turns the conveyor off to allow the spreader vehicle to pass or be passed. Both of these features will operate any time the respective switch is pressed, regardless of man/auto mode or vehicle speed. The Blast has an optional off-delay timer that holds the Blast output on for up to 30 seconds. If the operator needs to stop the timer, press the Blast switch momentarily and the Blast timer will instantly end.

To **unload** the spreader select manual mode and turn the Rate knob up (full CW). This will unload conveyor and not add to the data logging, but only while the vehicle is stopped.

Pass works as a push on / push off function. The first push will activate the Pass feature (conveyor off) and the second push will de-activate the Pass feature (conveyor off). There is a option for remote Pass, see the calibration procedure.

The automatic **Rate** control is a hands free operation that maintains a constant feed rate. The operator adjusts the granular rate using the display. The granular rate ranges from 20 lbs/mile on the lowest setting up to 3000 lbs/mile at the maximum setting. There is a spread rate limit that's adjustable from 100 to 3000 lbs/mile

Pulses from the transmission sensor create the ground speed signal. When the vehicle is stopped (zero **MPH**) the display will flash (dimming) the desired spread rate to indicate no ground speed pulses are being received. Once the vehicle begins moving and the pulses are present, the display stops flashing, the feed rate is displayed steady (non-flashing). As the vehicle begins moving the conveyor shaft rpm will automatically increase in direct relation to the vehicle speed, keeping the spread rate constant. At 1/2 mph the spinner automatically drives to a preset level.

The CS102 calculates the **accumulated pounds** of the delivered material. The total weight is always being recorded whether in Manual, Auto or Blast mode. There are eight internal accumulators, one for each product. The display shows this value in 10's of lbs. So that a reading of 1200 will be a weight of 12,000 lbs. All eight product totals are retained and are always available for printing.

The operator can quickly **view** and/or **clear** the accumulated pounds of the selected product with the Lane switch set to Accum. (prod). To clear hold down the Blast switch. The display will show "AC 30" The 30 will decrement to 0 (approx 3 seconds) and then clear the accumulator.

To **change the selected product**. First, set the Lane switch to the Accum. (Prod) position and press the Pass switch up (select). The current product number will show. Next, continue to hold the Pass switch up and turn the Rate knob to select a different product. Release the Pass switch and the new product is locked into memory.

Front Panel Controls

The **mode switch** is located in the upper left corner and is used to select three operational modes.

Off…… When the mode switch is Off all power is removed from the valve drivers, sensors and comm. port. Do not use the mode switch to stop and start the valve drive in order to implement spot spreading. Use instead, the Pass switch for spot spreading.

Granular…….. The granular position allows the operator to use the feed Rate knob to directly adjust the granular output, while viewing the feed rate in lbs./mile on the display.

Run Pre-wet… The pre-wet mode operates both the granular spreader and a small liquid pump. The ratio of liquid to granular material is gallons per ton.

Set Pre-wet….. The operator uses this selection to view and/or re-adjust the liquid -granular ratio using the feed Rate knob.

De-icing…… The De-ice mode controls a large liquid pump to deliver liquid at a fixed rate, gallons per mile. There is no spinner output in this mode. Granular spreading equipment and the large liquid tank required for De-icing cannot both fit onto the same truck. The CS102 uses the same output to run either the granular control valve or the De-ice control valve, but not both simultaneously. The vehicle wiring and hydraulic system are changed when switching between the granular and De-ice modes.

The **lane switch** is used to adjust the spinner output and to operate some special features. It's located in the lower left corner of the panel.

Off …… Turns the spinner output off. The display denotes this mode with a small upper case 0 in the left most digit.

1, 2, 3, 4……. Spinner output is active. The spinner speed has four preset levels established in the calibration procedure. The spinner speed is typically set using actual granular material since the material weight will tend to alter the spinner speed. The spinner drive can be programmed to shut off at zero mph or remain on at zero mph. In manual mode the spinner always remains on at zero mph, requiring the operator to manually set the spinner OFF.

Accum (Prod). View the accumulated pounds dispensed. Similar to a trip odometer this accumulator can be reset to zero. The alternate use for this position is to change the product. Hold the blast switch and use the feed Rate knob to select the product number

Cal …… This position is used to place the CS102 into the calibration mode. To change calibration settings requires a pass code.

Man …… This position sets the CS102 into a manual mode. Use the Pass/Blast switch to set the manual mode on or off. The power up default is auto mode. The calibration procedure allows the installer to disallow manual mode by the operator.

The **Rate knob** is located in the lower right In Automatic mode the Rate knob adjusts the desired application spread rate. The full CCW position of the Rate knob always turn the conveyor OFF, regardless of the vehicle speed or selected mode. In Manual mode the Rate knob directly sets the electro-hydraulic output for the conveyor valve.

The **display** shows numeric values between 0 to 99999. For automatic and manual mode the display shows the spread rate in lbs./mile. When the power switch is in the Total position the display shows pounds/10.

Display	Explanation
° 0	Rate knob full CCW (conveyor off), spinner off
20	Minimum feed rate, spinner on
-00-	Manual mode, conveyor = 0% output
bL yy	Blast is active, timer on. yy is timer (seconds)
Prod#	Show the selected product number, (# = 1 thru 8)
AC xx	Clearing the product totals, xx = 3 sec. timer
P zz	Programming menus, zz = menu number 1-56
E zz	Error codes, zz = error number 01 thru 12

Error codes

The CS102 can detect several system failures. Each of these is presented to the operator through a set of error codes. If during operation an error should occur the operator should make note of the code (E01, 02, etc.) and then press the Blast switch to clear the error. If the error does not clear then system will require immediate attention by a qualified technician. Error codes may be reset by pressing Blast.

Er 01 no conv Fb pulses / automatically cross calibrates to open loop calib
Er 02 no conv Fb pulses / cross calib not available
Er 03 conveyor (De-ice) valve, over current
Er 04 conveyor (De-ice) valve, open circuit
Er 05 spinner valve, over current
Er 06 spinner valve, open circuit
Er 07 cpu watchdog, cycle power to reset
Er 08 failed fuse, replace with 5x20mm 5 amp
Er 09 Pre-wet coil, over current
Er 10 Pre-wet coil, open circuit
Er 11 Pre-wet feedback fail
Er 12 De-ice feedback fail

PROGRAMMING

Introduction

The CS102 uses the front panel to view and modify all settings within the computer's memory. There are no special tools required. The front panel knobs and switches let you view each setting. To make changes to the programmed values requires you first enter a password. Without a password you can view any of the internal memory settings. Each program variable is selected by scrolling through a list of menus. Each menu is numbered, P01 thru P56.

Before you start --- think safety

When making program modifications the CS102 will automatically activate the hydraulic functions. Prior to programming ensure the vehicle is safe and all personnel in the area are notified.

How to access and edit the calibration data (GoTo and Enter commands)

Select program mode P01

1. Power switch = On (any mode) + Lane switch = Cal. Display shows [=====] five double-dashes Press and hold Pass switch and adj. Rate knob = P01. [P01 is the password menu]
2. Hold the Blast switch, adjust Rate knob until display = password (4836)
3. Release Blast switch, You are now ready to GoTo any program menu Pxx and make changes.

GoTo Pxx Select the desired menu number to edit (or view)

4. Hold Pass sw. and adj. Rate knob until the display = Pxx (xx = menu number)
5. Release the Pass sw., display = current stored value

Edit (or view) existing value

6. Hold Blast and adj. Rate knob until the display = [new value]
7. Release the Blast sw to save the value into memory.

Programming tips

While in the Calibration mode and you wish to know the menu number you're presently viewing, simply press the Pass switch but do not move the Rate knob.

When you press and hold the Blast switch while turning the Rate knob, the display will scroll through the full range of data values for that menu. When the menu requires a choice between features instead of numeric data the display will show alpha symbols, such as [rP] which stands for remote pass mode. When you release the Blast switch you will notice a brief dimming of the display. This indicates a save to memory has been made.

The calibration mode has some special features designed to assist the installer. Some of the menus allow the conveyor or spinner to operate while you're in program mode or read the sensors output pulses or report valve drive in milliamps, etc. example: P20 is where you set the mph calibration (cts/mile) but P20 + Prod lets you view actual mph [P20 + Prod means at menu P20 rotate the Lane switch CW one position to the Prod position to view the actual mph]. The + Prod option is available on several menus.

The task of programming uses the above procedure, notably steps 4 thru 7 which are repeated for each program setting you wish to edit. When you have completed editing the CS102's settings you can return to the run mode by moving the Lane switch to the Off position. As long as the unit is powered up the password is retained. This allows you to move between calibration mode and a run mode without re-entering the password each time.

Programming menus

Menu #	Variable name	Range or Selection
Information settings		
P01	Password	[4836]
P02	Truck number	[0 - 250]
P03	Serial number	[set by factory]
P04	Checksum	[xxxx] used program verification
P05	Firmware version	[yyyy] used for program upgrades
Valve settings for granular mode		
P10	PWM frequency	[30-250 hertz]
P11	Conveyor min speed	[2-100%] or [50-2500ma]
P11 + Prod	Conveyor min speed	[view feedback hertz if conveyor if set to closed loop]
P12	Conveyor max speed	[2-100%] or [50-2500ma]
P12 + Prod	Conveyor max speed	[view feedback hertz if conveyor if set to closed loop]
P13	Conveyor cross calib.	[10-999 max hertz] or [nA = no cross calib]
P14	Conveyor test mode	[view conv. valve ma] Rate knob sets conv. output
P14 + Prod	Conveyor test mode	[view conv. feedback hertz] Rate knob sets conv. output
P15	Lane 1 spinner speed	[0-100%] or [10-2500ma]
P15 + Prod	Lane 1 spinner current	SC = actual spinner current
P16	Lane 2 spinner speed	[0-100%] or [10-2500ma]
P16 + Prod	Lane 2 spinner current	SC = actual spinner current
P17	Lane 3 spinner speed	[0-100%] or [10-2500ma]
P17 + Prod	Lane 3 spinner current	SC = actual spinner current
P18	Lane 4 spinner speed	[0-100%] or [10-2500ma]
P18 + Prod	Lane 4 spinner current	SC = actual spinner current
Calibration settings for pulse sensor inputs		
P20	MPH calib, counts / mile Display	[250 - 15280] X10 actual [2500 - 152800]
P20 +Prod	View actual mph	Press Blast use Rate knob, display = speedometer
P21	mph sensor type	[dc - AC] dc = hall effect and World, AC = VRM
P22	20 mph simulated	[S-OFF / S-on] simulates a 20 mph signal input
P30	Conveyor calib	[50 - 1499 lbs / minute open loop mode] [0.020 - 1.499 lb/pul closed loop mode]
P31	Conveyor pulse dump	[cd 10] hold Blast, display counts down 10,9,8…2,1,0 release Blast to view the accumulated pulses received from the conveyor sensor. Use the Rate knob to adjust the conveyor speed. Rate knob = CCW stops the conveyor. Blast resets the accumulated pulses.

Granular Product settings

Note, Product 1 is always the product used to calibrate the conveyor

P32	Prod 2	[ratio] = weight prod 2 / weight prod 1
P33	Prod 3	[ratio] = weight prod 2 / weight prod 1
P34	Prod 4	[ratio] = weight prod 2 / weight prod 1
P35	Prod 5	[ratio] = weight prod 2 / weight prod 1
P36	Prod 6	[ratio] = weight prod 2 / weight prod 1
P37	Prod 7	[ratio] = weight prod 2 / weight prod 1
P38	Prod 8	[ratio] = weight prod 2 / weight prod 1

Granular System settings

P40	Conveyor servo mode	[OP = open loop] [CL = closed loop]
P41	CS102 Run mode	[An] = (both auto and manual modes enabled) [AO] = (auto mode only)
P42	Maximum feed rate	[100-3000] lbs/mile. Limits operator's upper setting
P43	Blast off delay timer	[1-10 seconds] [b-OFF timer off, Rate knob = CCW]
P44	Blast rate	[rl] Blast = maximum valve [rA] Blast = maximum rate
P45	Option input	PAS = remote pass input gEAr = gearbox input BLA = Blast, PSI = pressure sw input
P46	Gearbox ratio	[nA = not available] [.20 - 5.0] = gearbox ratio
P47	Spinner mode	[A OFF] = (spinner will turn on/off with mph) [n OFF] = (spinner will NOT turn on/off with mph)
P48	Conveyor drive	[C-PEr] calibrations in percent mode, % [C-cur] calibrations in current mode, ma
P49	Spinner drive	[S-PEr] calibrations in percent mode, % [S-cur] calibrations in current mode, ma

Real time clock settings

P50	Minutes	0-59
P51	Hours	0-23 (24 hour mode)
P52	Day of week	1-7 (Sun - Sat)
P53	Day of month	1-31
P54	Month	1 - 12 (Jan - Dec)
P55	Year	1997 - 2096 (Y2K compliant)
P56	metric/English	[rc = metric] [EH = English]

Pre-wet settings

P60	Maximum pre-wet rate	[2.0 - 16.0 gal/ton] set operators upper limit
P61	Max pre-wet output	[2.00 - 23.99 gal/min] open loop measure at valve max [200 - 2399 pul/gal] closed loop use sensor manf rating
P62	Min pre-wet output	[0.1 - 2.0 gal/min] open loop measure at valve min for closed loop operation this variable is not used
P63	Pre-wet valve min	[1-97%] set for minimum acceptable spray pattern
P64	Pre-wet valve max	[1-97%] set for maximum liquid pump output
P65	Pre-wet servo mode	[P OPn = open loop] [P CLO = closed loop]
P66	Pre-wet drive	[P PCn = percent mode] [P CUr = current mode]

De-ice settings

P70	Maximum De-ice rate	[10 - 500 gal/mile] set operators upper limit
P71	Max De-ice output	[2.0 - 149.9 gal/min] open loop measure at valve max [2.0 - 149.9 pul/gal] closed loop use sensor manf rating
P72	Min De-ice output	[0.5 - 20.0 gal/min] open loop measure at valve min for closed loop operation this variable is not used
P73	De-ice valve min	[2-100%] set for minimum acceptable spray pattern
P74	De-ice valve max	[2-100%] set for maximum liquid pump output
P75	De-ice servo mode	[d OPn = open loop] [d CLO = closed loop]
P76	De-ice drive	[d PCn = percent mode] [d CUr = current mode]

Comm Port

The CS1 is equipped with a communications port on the front panel. The purpose of this comm. port is to provide the user with a convenient method for transferring data to and from the controller using a standard laptop computer. There are two terms used to define data transfers. **Upload** defines the action of sending data from the laptop to the controller and **download** is the act of transferring data from the controller to the laptop.

The controller contains an application program within its internal memory that completely defines how the unit will function as a spreader control. From time to time the factory may create a new version of the application program. Typically this is done to fix a bug, improve or add a new feature. The user can upload a new application program (upgrade) through the comm. port using a laptop computer.

To perform an upload procedure the user needs the following;

1) a comm. port cable ref. p/n CS100C1A
2) a laptop computer running Windows™ with a resident terminal emulator program
3) the new (upgraded) application program, this may be contained a disk or received by e-mail

The file naming convention used for application program upgrade is as follows

general form: CS102Fyy.s19
xx = the family name
yy is the version

example: CS102F1A 01 family, version 1A

Note, all application programs for the CS1 controller are under copyright protection. All rights are reserved by Ditco Inc. You are NOT authorized to copy or use this program for any reason other than to upgrade an existing version within a CS1 controller

As additional security the integrity and identification of the application program can be confirmed by the checksum. The program version checksum can be determined using the standard program mode for the CS1 using the front panel controls, see section PO4 cs and PO5 f/w version

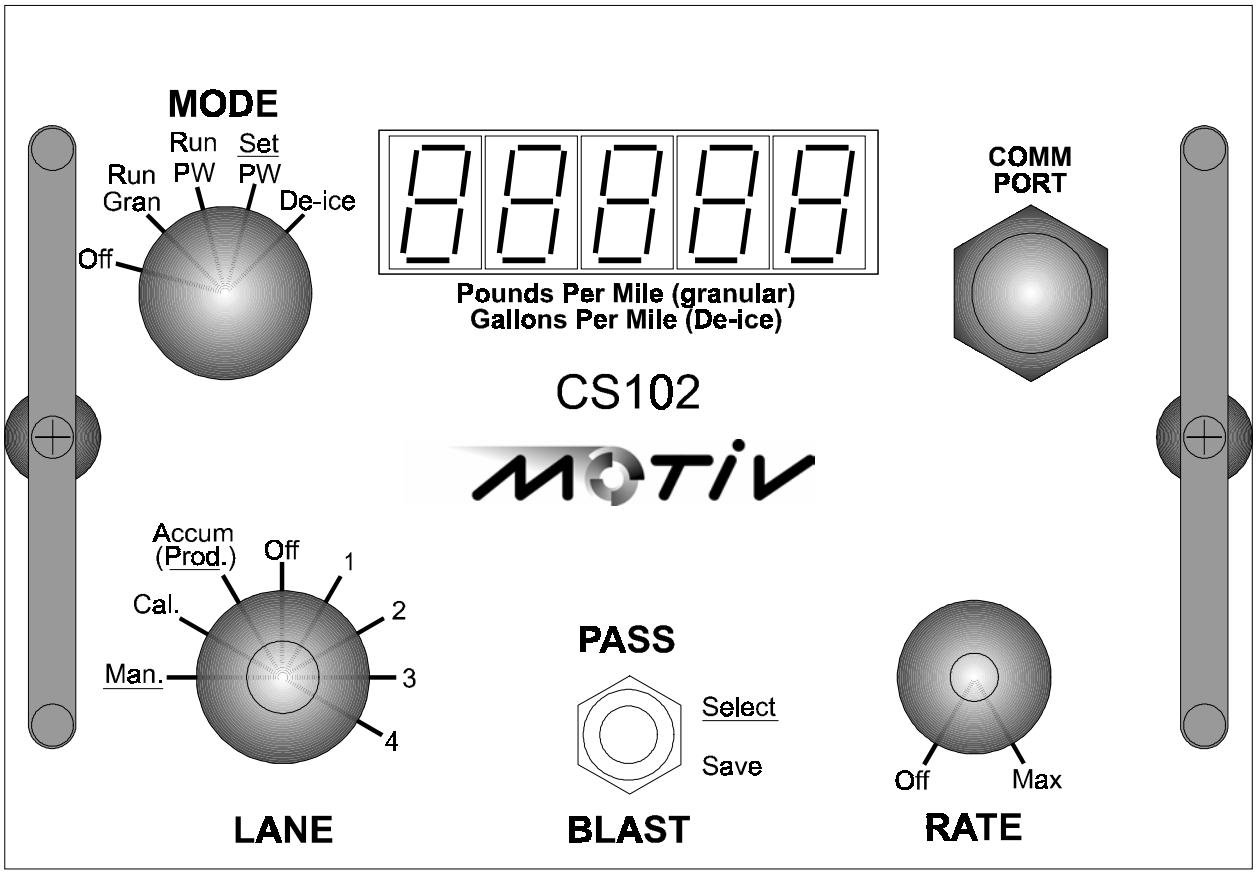
The following procedure is for a laptop connection to the front panel comm. port. The connector is a 4 pin Conxall. The proto call is as follows:

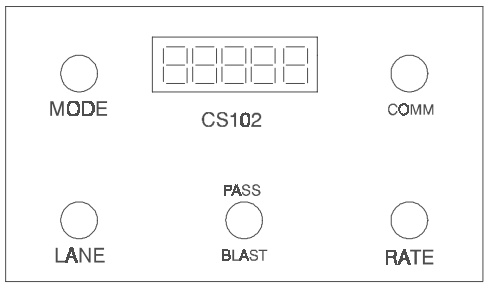
Baud rate	9600
Data bits	8
Parity	None
Stop Bits	1
Flow control	Xon / Xoff
Transmit buffer	set as low a speed as possible (1)
ASCII setup	character delay 1ms

With your terminal emulator setup and the cable installed, Power up the CS1
" " indicate the characters to be typed, use enter key to send

Type "xy" this will return with a menu (this command must be lowercase)
Type "p" this will set the CS1 up for program mode (the CS1 will respond with Ready)
From your terminal emulator Transfer / send text file (send CS102F2Y.S19)
Type "v" this will verify the checksum within the CS1

VERY IMPORTANT If the process of re-programming the CS1 fails, either due to incorrect terminal settings or power interruption or other causes, the CS1 may not be able to try again. If this happens you will have to send the unit back to the factory for re-programming.


MODE
Run Gran
Run PW
Set PW
De-ice
Off
Pounds Per Mile (granular)
Gallons Per Mile (De-ice)
COMM PORT
CS102
Accum (Prod.)
Off
1
2
3
4
Cal.
Man.
LANE
PASS
Select
Save
BLAST
Off
Max
RATE



GRANULAR CONTROL

WITH PRE-WET OPTION

CUSTOMER SUPPLIED
SERVICE DISCONNECT

SAFETY SWITCH

6 — + 12 VDC VEHICLE POWER

9 — VEHICLE GROUND

2 — CONVEYOR VALVE SUPPLY — CONV VALVE

7 — CONVEYOR VALVE DRIVE

2 — SPINNER VALVE SUPPLY — SPN VALVE

4 — SPINNER VALVE DRIVE

2 — PRE-WET VALVE SUPPLY — PRE-WET VALVE

3 — PRE-WET VALVE DRIVE

8 — MPH SIGNAL — TRANSMISSION SENSOR

1 — CONVEYOR CLOSED LOOP FEEDBACK SIGNAL OPTIONAL — +12V, GND — SHAFT PULSE GENERATOR

5 — PRE-WET CLOSED LOOP FEEDBACK SIGNAL — +12V, GND — SHAFT PULSE GENERATOR

OPTION INPUT, PASS, BLAST, GEARBOX, PSI SW

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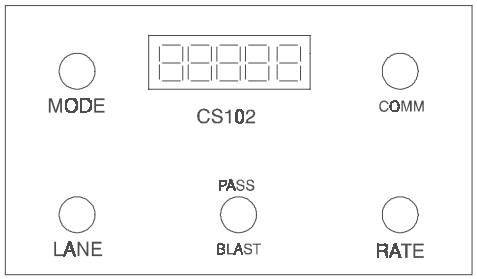
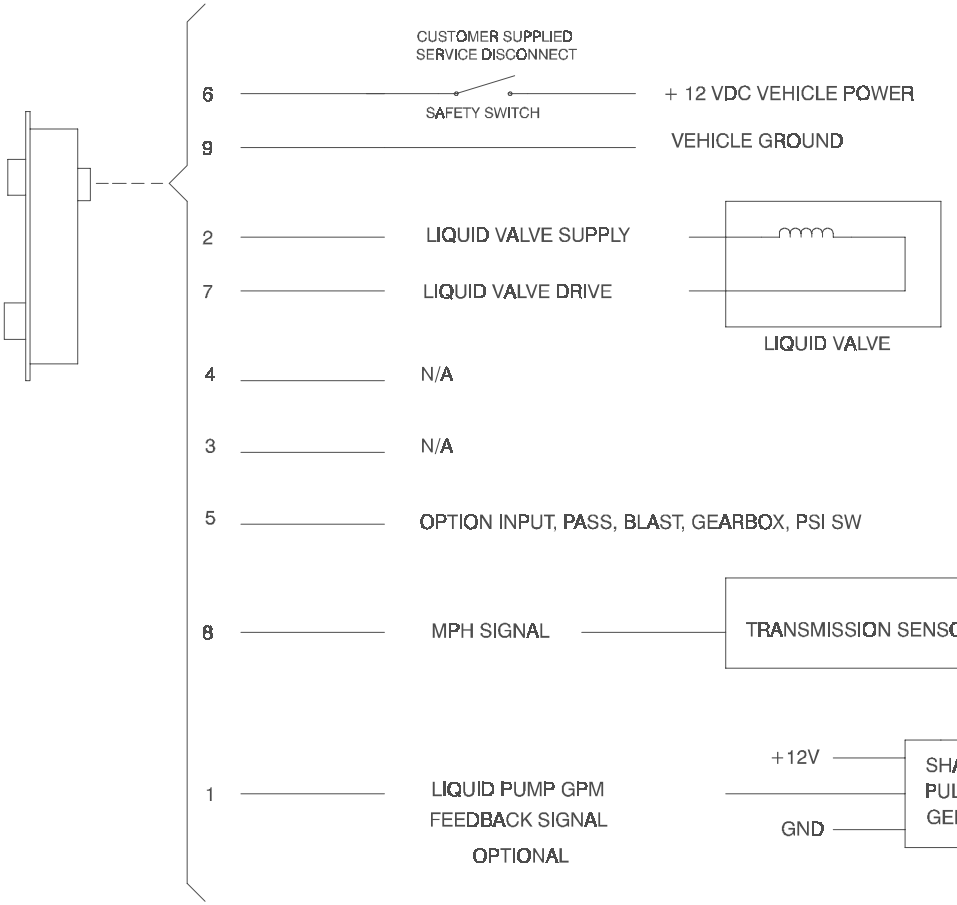
DATE Fri May 03 2002 09:48:04



DE-ICE CONTROL



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