

US: 5000AP Installation Supplement
R7/1/10



Smartscan Incorporated
33083 Eight Mile Road
Livonia, MI 48152
TEL: (248) 477-2900
FAX: (248) 477-7453

SMARTSCAN INCORPORATED
Livonia, MICHIGAN

5000AP

The use of this document is reserved exclusively for the use of Smartscan Incorporated customers and personnel. The information and drawings contained herein are the sole property of Smartscan Incorporated, and shall not be disclosed to any third party without the prior written consent for Smartscan Incorporated. Smartscan Incorporated makes no warranty of any kind with regard to this material, including but not limited to, implied warranties or fitness for a particular purpose. The information in this document is subject to change without notice. Smartscan shall not be liable for any errors contained herein for incidental or consequential damages in connection with the performance of use of this material.

In order for machinery to be guarded by the Smartscan 5000AP light curtain system, the machinery must be capable of stopping at any point in the machine cycle. The guarded machine must be wired such that any interruption of the defined area will cause immediate arrest of the dangerous motion of the guarded machine.

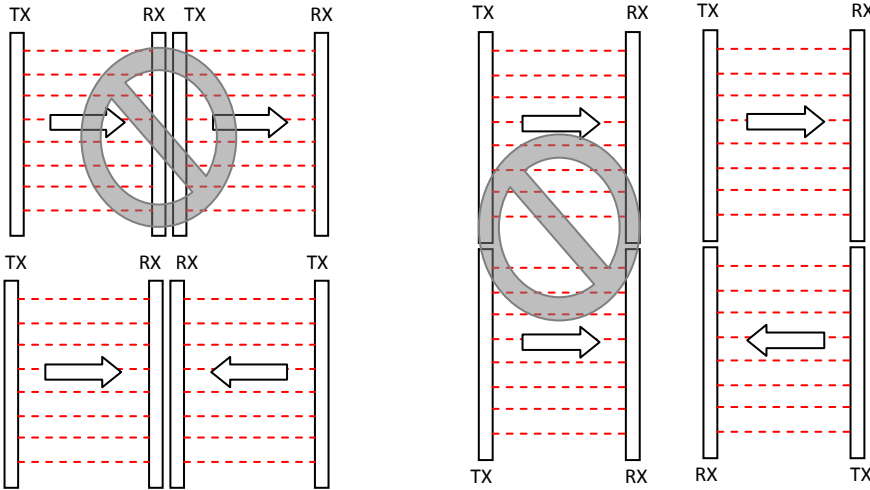
Smartscans 5000AP's ability to perform this function depends upon the appropriateness of the application and upon the Smartscan 5000AP 's proper mechanical and electrical installation and interfacing to the machine being guarded. If all mounting, installation, interfacing and commissioning procedures are not followed properly the Smartscan 5000AP system cannot provide the protection for which is was designed. The user has the responsibility to ensure all local, state, national laws, rules, codes or regulations relating to the installation and use of this system in any particular application are satisfied.

The user has the sole responsibility to ensure that the Smartscan 5000AP system is installed and interfaced to the guarded machine by "qualified persons" in accordance with this manual and applicable safety regulations. A "qualified person" is defined as " a person or persons who, by possession of a degree or certificate of professional training, or who, by extensive knowledge, training and experience has successfully demonstrated the ability to solve problems relating to this subject matter and work" (ANSI/AME B30.2-1983)

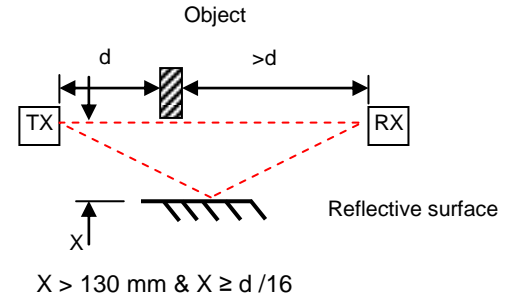
Light Curtain Mounting Considerations

Light Curtain Orientation

TX - Transmitter RX - Receiver

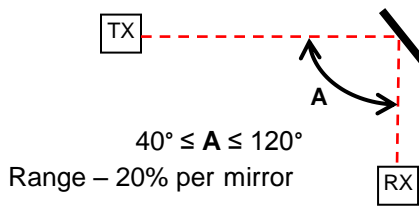


Proximity to reflective surfaces

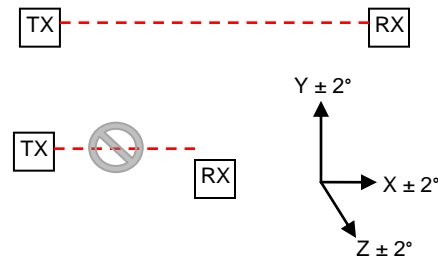


X is minimum distance between the light and the reflective surface. The closest distance of TX or RX to the object approaching the light curtain is d.

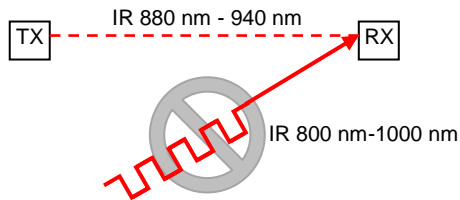
Use with Mirrors



Light Curtain Alignment



Optical Short Circuit Prevention



Light Curtain Mounting

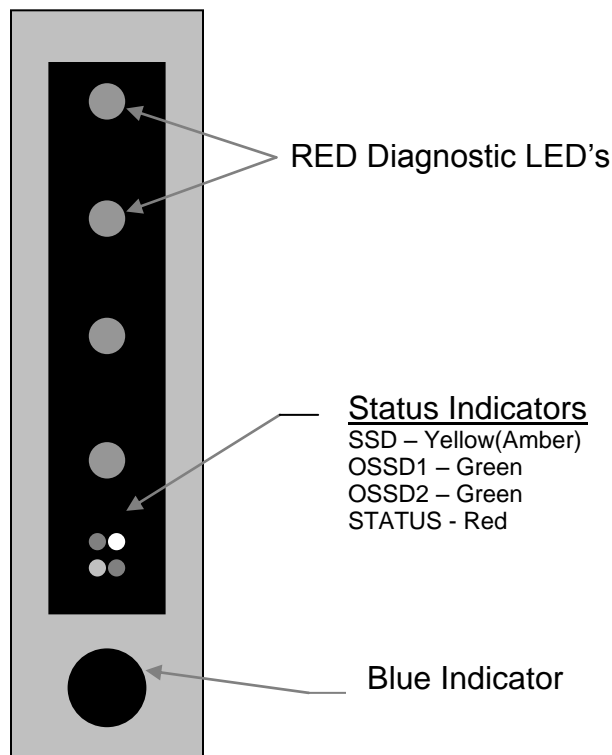
Light curtain must be securely mounted such that the operator cannot reach the hazard without passing through the light curtain sensing region.

The operator should not be able to reach over, reach under or walk past the protective device without interrupting its sensing region. Additional guarding may be required to achieve this task.

Warning: Do not repair or modify the 5000AP Light curtain. The 5000AP safety light curtain is not cite/field repairable and can only be repaired at the Smartsan.

Principle of Operation

The Smartscan sensing unit consists of a transmitter and a receiver column that face each other across an area to be safeguarded. The transmitter contains a row of infrared, light emitting diodes that sequentially transmit parallel beams of energy to corresponding receiving diodes in the receiver column. When the control/monitoring unit detects an obstruction in the optical path of one, or more of the beams that form the sensing field, the output signal switching devices (OSSD's) will turn-OFF immediately.



Diagnostic Indicators

For diagnostic purposes visible red LED indicators adjacent to each infrared transmitting diode are provided, together with four LED status indicators mounted inside the exit window in the transmitter column.

When the light curtain is 'active' (unobstructed) the red LED diagnostic indicators in the transmitter column are all 'ON' and at low brightness. When the optical path of one of the beams in the light curtain is obstructed, its corresponding LED indicator glows at full brightness indicating which particular beam has been obstructed.

Status Indicators

Illumination to a steady 'ON' condition of the amber LED status indicator confirms the secondary switching device (SSD) is in the ON state.

Illumination of No. 1 green LED status indicator confirms that output signal switching device OSSD 1 is in the ON state.

Illumination of No. 2 green LED status indicator confirms that output signal switching device OSSD 2 is in the ON state.

Illumination of the red LED status indicator confirms the light curtain is in a muted condition.

Condition Indicator - AP Models only

This is comprised of one (or two) blue lamps

The lamp operates with a pattern over a four second cycle, comprising eight periods of 0.5 seconds, represented by the boxes. A '1' indicates lamp on and an '0' indicates lamp off.

Pattern:

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

Appearance: Lamp Off

Status: Light curtain active, outputs energized.

Pattern:

1	1	1	1	1	1	1	1
---	---	---	---	---	---	---	---

Appearance: Steady on

Status: Self-muting active (APT, APL models only).
All external muting inputs active (AP models without self-muting.)

Pattern:

1	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

Appearance: Flash, long off, flash, long off, etc.

Status: Lockout - the system has either just been powered up or has entered the lockout state because of a fault.

Pattern:

1	0	1	0	0	0	0	0
---	---	---	---	---	---	---	---

Appearance: Flash, flash, long off, flash, flash, long off, etc.

Status: Outputs OFF - the light curtain is obstructed (or is awaiting reset following an obstruction - latched mode only).

Pattern:

1	1	1	1	0	0	0	0
---	---	---	---	---	---	---	---

Appearance: Equal on/off blinking

Status: Guard Override - the curtain is temporarily muted in guard override condition, 25s max.

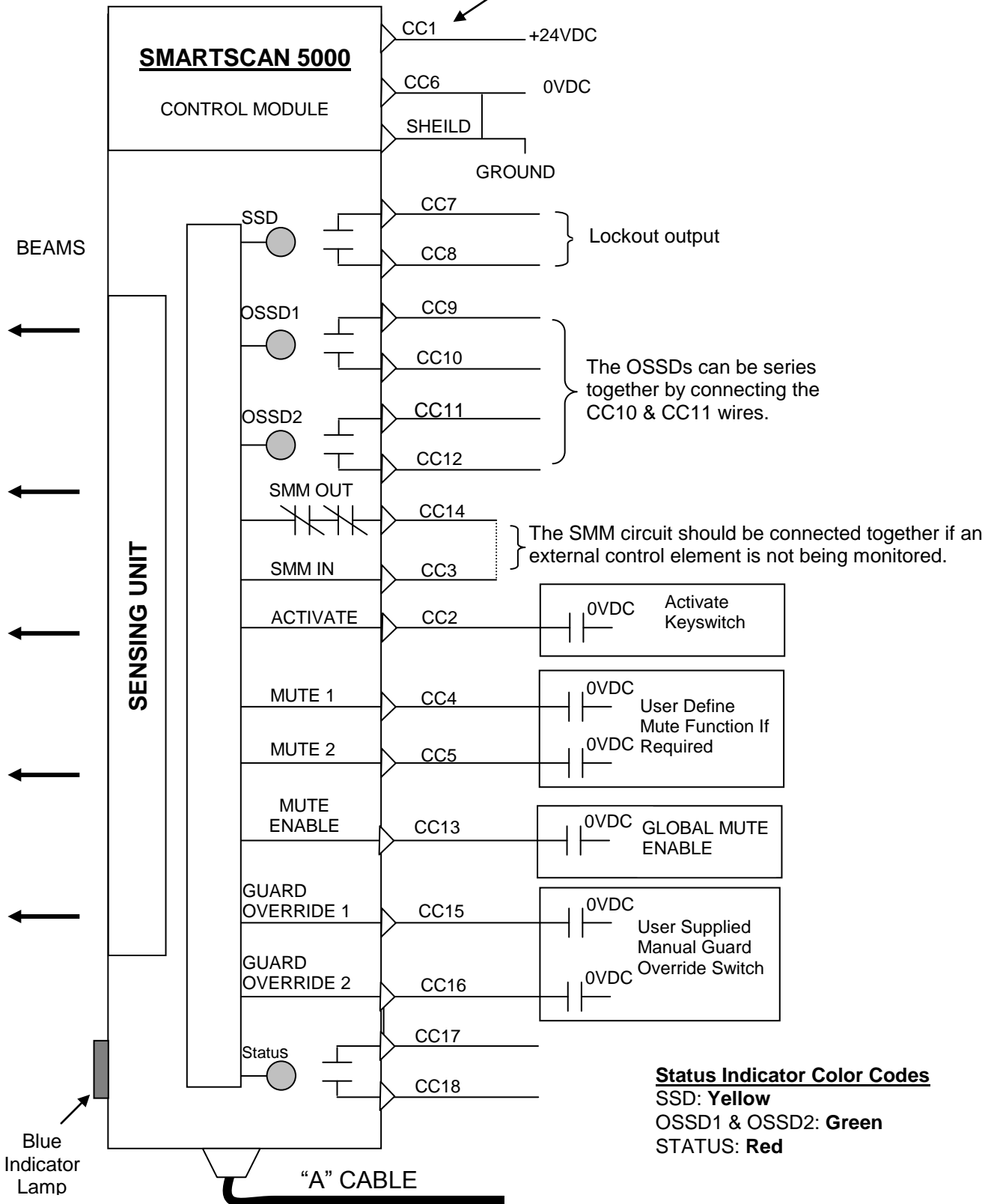
Note: The condition indicator lamp(s) is current monitored. Failure of the filament(s) will prevent muting.

Lamp test - to check operation of the lamp, set the key switch or other means to the 'activate' position for 4 seconds (activate input: blue conductor to 0 Volts). The lamp should illuminate for 2 seconds and then go out.

CONTROLS DIAGRAM

THE CONDUCTOR COLOR CODE TABLE(CC#) IS ON PAGE 16

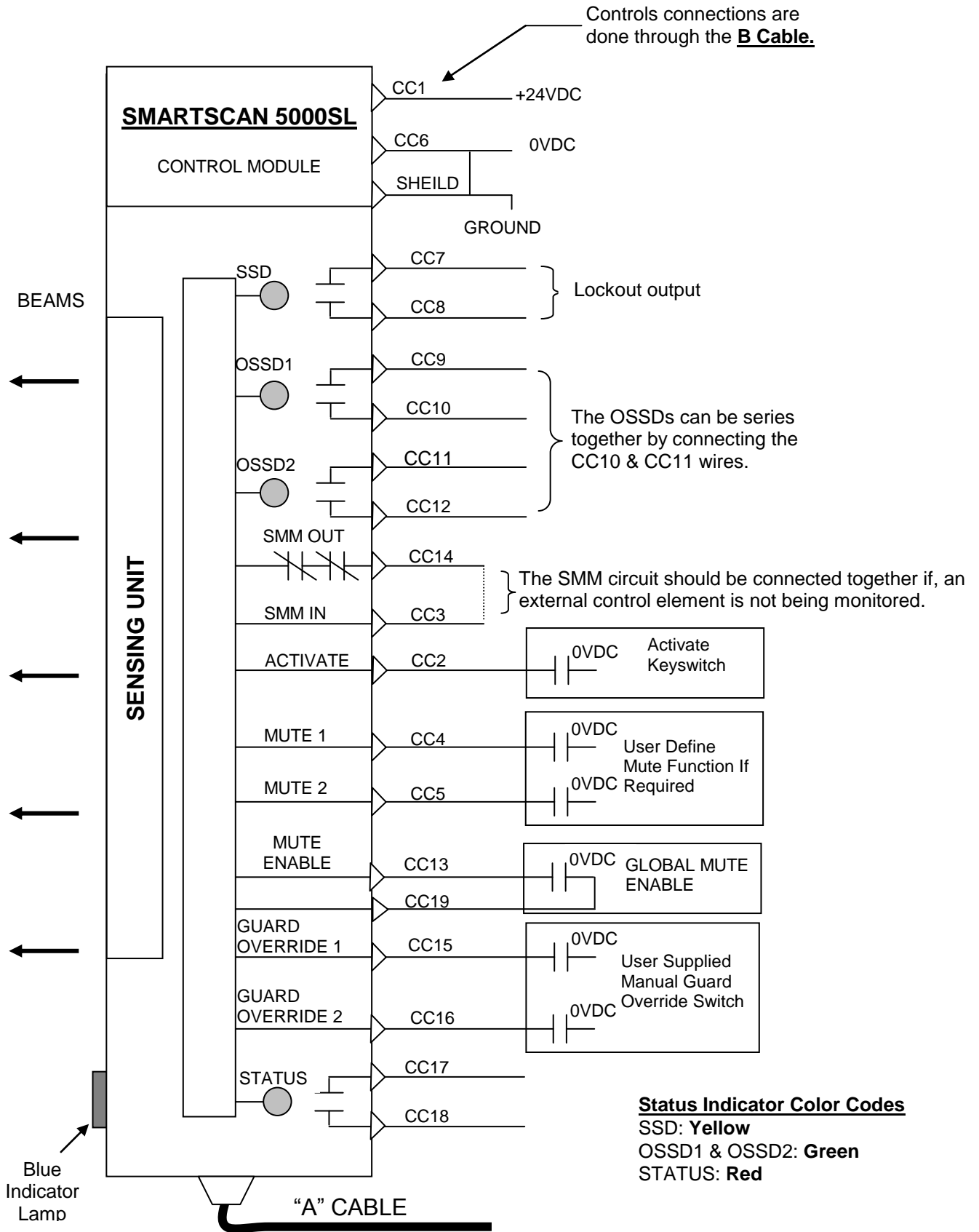
Controls connections are done through the **B Cable**.



Status Indicator Color Codes
 SSD: Yellow
 OSSD1 & OSSD2: Green
 STATUS: Red

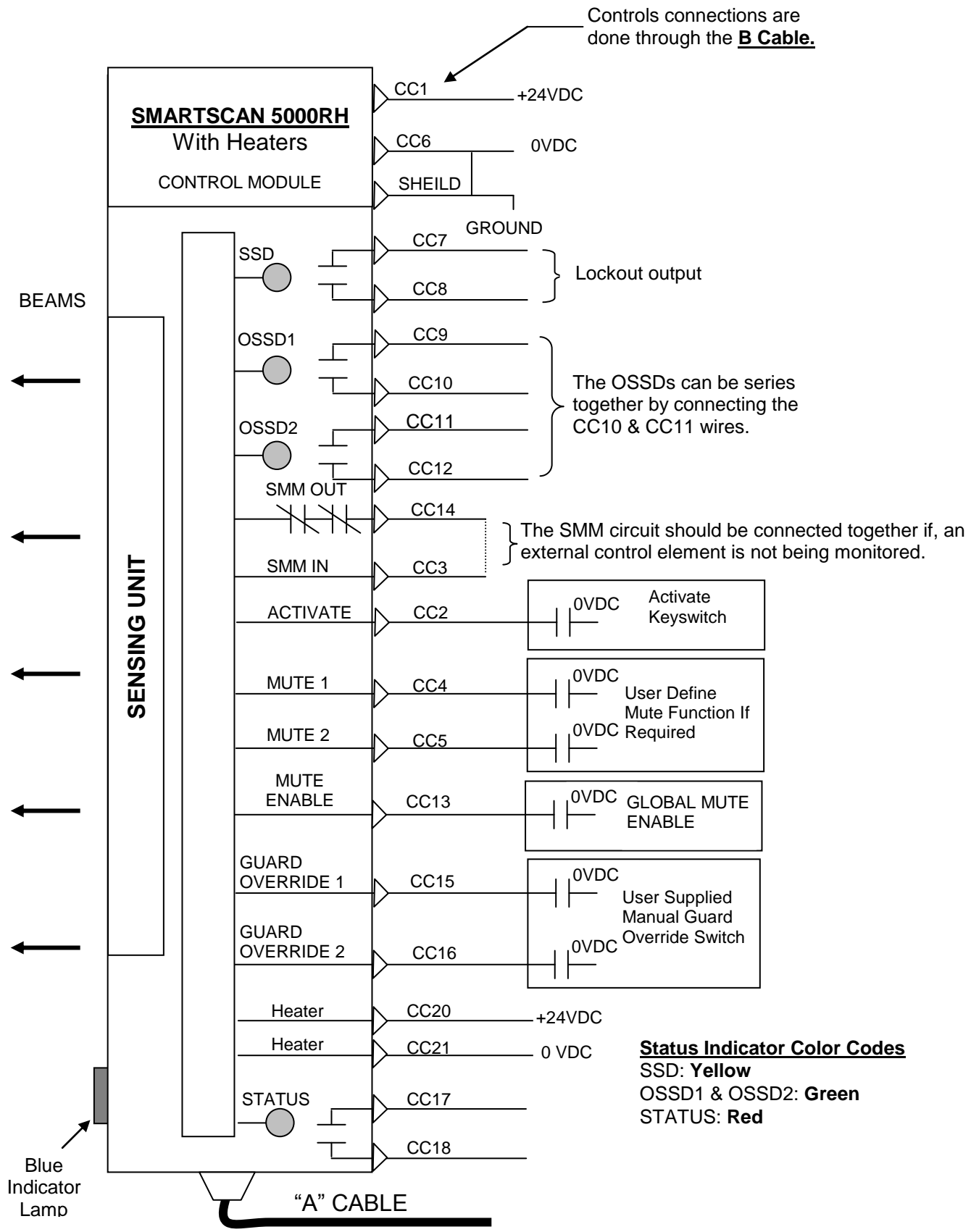
SL CONTROLS DIAGRAM

THE CONDUCTOR COLOR CODE TABLE(CC#) IS ON PAGE 16



RH CONTROLS DIAGRAM

THE CONDUCTOR COLOR CODE TABLE(CC#) IS ON PAGE 16



Key Switch -Models with Remote Control Unit Only

Two types of key switch operation are available:

Activate - Run- Activate - Remote unit 5RAPO
Activate - Run- Guard Override - Remote unit 5RAPG

The activate function is the same in both cases. Turn the key momentarily to the 'activate' position and allow it to return to 'run' position. This momentarily connects the activate input to L - and takes the light curtain through its start-up sequence automatically. This function is required at initial power up and also to recover from a lockout situation that arises during normal operation. If lockouts occur regularly there is a system problem and maintenance is required.

Guard Override Key Switch

As noted above, Model 5RAPG incorporates a key switch having a guard override position.

Guard Override - This function is provided on the AP system to temporarily suspend the protective function of the light curtain, following a trip condition during the period when the light curtain is obstructed. An example would be when a pallet is obstructing the light curtain following a lockout condition.

To initiate OSSD1 and OSSD2 switching contacts to an 'on' condition following a lockout, it is necessary to remove the obstruction from the light curtain's field of detection.

To remove the loaded pallet, connect Guard Override 1 and 2 to L-Volts via suitable switching circuitry. This action automatically closes the OSSD1 and OSSD2 relays, thereby enabling the machine to be restarted for 25 seconds.

If it takes longer than 25 seconds to remove the load from the light curtain's detection field the light curtain's guard override function must be reset to enable another 25 seconds period.

To reset the guard override, momentarily open the connections between Guard Override 1 and 2 and L-Volts, and then remake the connections. Guard override of the light curtain is now active for a further 25 seconds.

Use Guard Override only when:

- (a) The reason for the blockage has been established
- (b) The light curtain is in view
- (c) No danger to any other person can be caused

AP Interface - Inputs

1. Activate - general reset - wire color CC2. Activate provides several functions, relating to reset and test.
 - start up
 - recovery from a lock condition
 - restart after interruption and subsequent clearance of the light curtain
 - lamp test

It is most unusual to design systems with activate tied low permanently, but this mode may be useful for presence sensing, particularly with horizontal curtains, in low/medium risk applications, perhaps to replace a safety mat. It must not be tied low permanently in applications where muting is employed.

2. Mute 1, Mute 2 - external mute inputs - wire colors CC4 and CC5.

These inputs are used for external muting of the curtain. The input signals should come from separate sources, so that a single fault cannot cause a failure of the protective function.

3. Mute enable - enables self-muting and external muting - wire colors CC13.

This signal must be low for muting to occur. It may be used as a third mute input on externally muted AP types. When self-muting light curtains (APT, APL) are used on conveyor systems 'conveyor run' usually actuates it. This technique makes deliberate bypass of light curtain more difficult when the machine is stopped.

*****SL MODEL MUTE ENABLE SIGNAL: WIRE CODES CC13 & CC19*****

4. Guard Override 1 - wire color CC15.
Guard Override 2 - wire color CC16.

These inputs are used to provide a temporary mute condition of up to 25 seconds. They are normally used only on conveyor systems. Both guard override terminals must be low to achieve the temporary muting.

Outputs - All Types

1. OSSD 1 - Safety output - wire colors CC9 and CC10.
2. OSSD 2 - Safety output - wire colors CC11 and CC12.

These two safety outputs respond to interruption of the light curtain (unless muted). The ON state is curtain clear and the OFF state curtain blocked. They are voltage free contacts from two independent safety relays, and must be wired to produce a machine stop condition when either is in the OFF state. Refer to page 4 for details.

Warning: - OSSD's should be wired to prevent machine operation unless the OSSD's are in the ON state.

Warning - Bypassing the light curtain safety relay outputs (OSSD's) has been known to cause serious injury including death.

3. SSD - Lockout output - wire colors CC7 and CC8.

This output is a safety backup. It is a pair of voltage free contacts from a safety relay, which are in the ON state during normal operation and in the OFF state at power-up and under lock out conditions. They should be wired to prevent machine operation unless in the ON state.

Power and Earth - All Types

L+ - Volts - Positive supply + 24VDC - wire color CC1

L- - Volts - Negative supply 0VDC - wire color CC6

Shield - Protective earth - screen braid.

The 24VDC must be connected with the correct polarity and come from a supply, isolated from the mains, with the negative pole earthed, corresponding to the specifications given on page 9.

The earth connection must be bonded to the machine frame and the protective earth conductor via low impedance connections.

Heater Units (ONLY)

+24VDC - Heater input 1 - wire color CC20

0VDC - Heater Input 2 - wire color CC21

The letters RH at the end of the part number designate heater units. These systems are typically used in freezer type applications and can be used in temperatures that do not extend below $-30^{\circ}\text{C} = -22^{\circ}\text{F}$.

SMM - All Types

SMM out - wire color CC14.

SMM in - wire color CC3.

SMM stands for Safety Monitoring Means (In the US know as MPCE monitoring) and is a means of detecting faults in equipment external to the light curtain that is involved in achieving the machine stop condition. BS6491 compliant installations must use SMM and Category 3 or 4 control systems, requiring single fault tolerant safety circuits with fault detection, use SMM as a way of achieving the fault detection within this sub-section of the control system at minimal cost.

SMM monitors the change of state of the final control contacts or valves in the machine and causes a lockout condition when a fault is detected. When SMM is not required, link SMM out to SMM in and do not connect these wires to any other circuit. A SMM wiring example is given on page 4.

Status Output - wire colors CC17 and CC18.

This output is provided on AP models only.

The status output a voltage free contact, which is in the ON state (When the light curtain is active, then the OFF state under all other conditions*). **The status output must not be used as a safety output!** Used for signaling status to the machine control system, this contact is particularly useful in system setups that incorporate diagnostic features.

* Can be ordered for when the light curtain is in the muted states.

Notes:

1. **For two color wires above, the first color is the main color and the second color is the tracer.**
2. **Operational sequences are described in the installation sheet provided with each light curtain.**
3. **Inputs may be activated manually or automatically. Some models have key switches and push buttons for manual functions.**

Electrical Connections

All input and output connections from the Smartscan system are via a 25 way 'D' type connector - user cable (B). The cable is terminated in either the user's equipment, Smartscan marshalling unit or power supply.

If an optional control/function module is supplied there may be additional connections related to that module.

Note: If the Smartscan system is connected directly to a 24V DC source supplied by the user, it must be regulated and suppressed to prevent transient voltages and other forms of electrical interference from affecting correct operation of the Smartscan equipment.

User Cable (B) for AP Systems

Color Code #	'D' Pin	Function	Signal	I/O
CC1	1	L+ Volts	+24 V DC	+24V DC
CC2	2	Activate	Start, Reset SSD, Lamp Test	Input
CC3	3	SMM In	Safety Monitoring Means	Input
CC4	4	Mute 1	Mute Input 1	Input
CC5	5	Mute 2	Mute Input 2	Input
CC6	6	L-Volts	0V DC (Ground/Earth)	0V DC
CC7	7	SSD	Switching Contact (Isolated)	Output
CC8	8	SSD	Switching Contact (Isolated)	Output
CC9	9	OSSD 1	Switching Contact (Isolated)	Output
CC10	10	OSSD 1	Switching Contact (Isolated)	Output
CC11	11	OSSD 2	Switching Contact (Isolated)	Output
CC12	12	OSSD 2	Switching Contact (Isolated)	Output
CC13	13	Mute Enable	Mute Enable	Input
CC14	14	SMM out	Safety Monitoring Means	Input
CC15	15	Guard Override 1	Override OSSDs	Input
CC16	16	Guard Override 2	Override OSSDs	Input
CC17	17	Status Relay 1	N.C. During Mute or While Light Curtain is Active	Output
CC18	18	Status Relay 2	N.C. During Mute or While Light Curtain is Active	Output
CC19	20	SL Mute Enable	Mute Enable signal used for SL units ONLY	Input
CC20	21	Heater Input	Heater unit input for RH units ONLY	Input
CC21	22	Heater Input	Heater unit input for RH units ONLY	Input
Shield	25	Ground/Earth		

The actual conductor color codes represented by the symbols CC# in the chart above are given in the conductor code table on page 16.

SPECIFICATIONS

Number of beams	2 - 32
Beam spacing (mm)	19, 25.4, 30.5 and multiples
Range (meters): T and L Models 2-16 beam models excluding T,L and ED types 18-32 beam models ED suffix models	. 1.0 - 2.2 meters 0.5 - 15 meters 0.5 - 5.0 meters 1.5 - 30 meters
Response time (maximum)	20 mS
Automatic check interval (maximum)	20 mS
Light type and wavelength	infra-red 940 nm
Ambient light max	20,000 lux (failsafe)
Temperature	Operating 0 - +40°C Storage -20 - +50°C
Humidity	0 - 95% (non condensing)
Enclosure rating	•IP54
Color	Yellow/RAL1006 gloss
Material and finish	Aluminum, chromate treated and polyester powder coated.
Weight - transmitter unit	2 kg typical(see individual data sheets)
Receiver unit	2 kg typical(see individual data sheets)
Fault resistance category to prEN954-1:5000 Other models	Category 4, Category 3
Conformity: Conventional straight models with standard interface only	EHSR's Machinery Directive BS6491 : 1 & 2: 1987
Noise	Less than 70 dBA in operation
EMC	EN 55022 Class B IEC 801 - 3 Level 2

- For more information about the IP or wash down rating contact Smartscan.
- | | |
|-------------------------|----------------------------------------------------------------------------------------------------------------------|
| Primary Output | 2 independent voltage free, N.O. safety contacts.
(OSSD See page 6 for detail.) |
| Secondary Output | 1 x voltage free N.O. safety contact.
(SSD See page 6 or detail) |
| Status Output | 1 x voltage free N.O. contact (not to be used for safety critical circuits - AP models only. See page 7 for detail). |
| Power Supply | 24V DC +/- 5%.
Maximum ripple 1%. |
| Power Consumption (max) | 500 mA |

Controls and Indicators

All AP light curtains with 'R' in the model number have a remote control unit that contains a condition lamp, status indicators and key/push button.

All non-remote AP light curtains have condition lamp(s) and status indicators situated in the transmitter column of the light curtain. There are two blue condition lamps, one on either side of the horizontal 'T' section. In Type 'L' light curtains both blue condition lamps are mounted on the horizontal part of the transmitter head. Straight AP models have a condition lamp mounted on the window of the transmitter unit.

Output Switching Devices

Secondary switching device (SSD):

Type - PCB relay with captive contacts. Contacts available = 1 x normally open (N/O)

Output signal switching devices (OSSD 1):

Type - PCB relay with captive contacts. Contacts available = 1 x normally open (N/O).

Output signal switching devices (OSSD 2):

Type - PCB relay with captive contacts. Contacts available = 1 x normally open (N/O).

Contact ratings (DC):

Max switching voltage	...	...	...	110V DC
Max switching current	...	...	...	1A
Max switched load (resistive)	...	...	...	50W
Max switched load (inductive)	...	...	...	20W
Max switching rate	...	...	...	10Hz
Min switching voltage	...	...	12V	
Min switching current	...	...	...	10mA

Contact rating (AC):

Max switching voltage	...	...	...	110V AC
Max switching current	...	...	...	1A
Max switched load (resistive)	...	...	...	50W
Max switched load (inductive)	...	...	...	20W
Max switching rate	...	...	...	10Hz
Min switching voltage	...	...	...	12V
Min switching current	...	...	...	10mA

Status Relay (AP Models only)

Type - PCB relay

Contact Rating	...	...	...	DC
Max Switching Voltage	...	...	...	30
Max Switching Current	...	...	...	.5A
Max Switching Load (Resisting)	...	...	...	15W
Max Switching Load (Inductive)	...	...	...	5W
Max Switching Rate	...	...	...	10Hz
Min Switching Voltage	...	...	...	12V
Min Switching Current...	...	...	10 μ A	

INPUTS

Inputs are 'active low' and should be driven by voltage free contacts between the input and the 'L-' connection or 'open collector' type PLC outputs using the same voltage reference. The specification for the external switch is given below.

Off state leakage current max	...	...	10 μ A	(leakage across contacts)
Off state voltage max	...	...	L+	(voltage across contacts)
On state current max	...	...	10mA	(current through contacts)
On state voltage max	...	...	1V	(voltage drop through contacts and wiring)

Fault Find Guide for AP Models

The AP model guards have a microprocessor controller interface, which performs the start sequence for the 5000 series guard. The microprocessor also adds additional mute functions and has a condition lamp.

The faultfinding procedures for the standard 5000 unit therefore apply. Also, if the condition lamp is flashing, refer to page 3 to determine the fault code. If the condition lamp has failed, the guard cannot be restarted.

Additional Fault Diagnostics for AP Models

<u>Problem</u>	<u>Possible Reason</u>	<u>Corrective Action</u>
All diagnostic LEDs 'on' but no blinking amber status LED	Failed initial start-up test.	Remove any signal applied to external mutes. Check connection ground (earth) connection. L-Volts must be grounded (earthed). Check light curtain within specified range. Check alignment of L.C.
Continuous amber LED status indicator flashing but no start-up.	No 'Activate' function of light curtain.	Check for any mute signals - remove mute signals. Lamp fused - replace. Apply L- Volts momentarily to blue wire to obsolete any switch faults.
Guard Stops on diagnostic LED beam 1 after testing.	Interlock	Check no signals to mutes (may be jammed mute), lamp blown - replace.
Amber status LED goes "off" after testing SMM (lockout).	Failed SMM	Bypass SMM to verify operation, link wires green to green/red - user cable "B".
Intermittent guard tripping. PLC connected to SMM input	Incorrect SMM	When the SMM is employed with a PLC output signal should be inverted and connected directly to SMM in. If more than one guard is connected to the PLC then separate I/O should be used for each guard.

If the procedures above have failed to rectify the problem, please phone or fax your Smartscan distributor.

Conductor Color Code Table

The color code numbers refer to the conductors of the cable types (BLACK, GRAY & WHITE) below. The cable type is the color of the cables. Each cable type has a different color code. Please make sure that the correct cable type is selected before you begin wiring your system

Color Code #	Black Cable	Grey Cable	White Cable	“D “ Pin
CC1	Red	Red	Red	1
CC2	Blue	Blue	Blue	2
CC3	Green	Green	Green	3
CC4	Yellow	Orange	Orange	4
CC5	White	White	White	5
CC6	Black	Black	Black	6
CC7	Brown	White/Black	White/Black	7
CC8	Violet	Red/Black	Brown	8
CC9	Orange	Green/Black	Yellow	9
CC10	Pink	Orange/Black	Violet	10
CC11	Turquoise	Blue/Black	Gray	11
CC12	Gray	Black/White	Black/White	12
CC13	Red/Blue	Red/White	Red/White	13
CC14	Green/Red	Green/White	Green/White	14
CC15	Yellow/Red	Blue/White	Blue/White	15
CC16	White/Red	Black/Red	Tan	16
CC17	Red/Black	White/Red	White/Red	17
CC18	Red/Brown	Orange/Red	Pink	18
CC19	White/Brown	Red/Green	Brown/White	20
CC20	Blue/Black	Orange/Green	White/Blue	21
CC21	Orange/Blue	Black/White/Red	White/Green	22
Screen	Screen	Screen	Screen	25