

**GUARDSCAN
GS120
LIGHT CURTAINS &
MULTI-BEAM SYSTEMS
TECHNICAL MANUAL 343351-00
English**

WARNING

Guardscan photo-electric safety systems are intended to protect operators working at or near dangerous machinery. They can only perform this function if they are correctly fitted to a suitable machine. It is essential that the full contents of this manual and all the authoritative documents referred to herein are fully understood before any attempt at installation is made. If in doubt contact your authorised Guardscan distributor.

IMPORTANT

This manual must accompany the product throughout its working life. Those persons responsible for the product must ensure that all persons involved in the installation, commissioning, operation, maintenance and servicing of the product have access to all the information supplied by the manufacturers of the machine and its safety system.

Guardscan Light Curtain Products are manufactured by:

Tapeswitch Ltd

Unit 38 Drumhead Road
Chorley North Industrial Park
Chorley
PR6 7BX
England

Tel : +44 (0) 1257 249777
Fax : +44 (0) 1257 246600
Email : info@tapeswitch.co.uk
Web : www.tapeswitch.co.uk

The Tapeswitch Group

Tapeswitch Corporation

100 Schmitt Boulevard
Farmingdale
New York
NY 11735
USA

Tel : +1 631 630 0442
Fax : +1 631 630 0454
E-mail : sales@tapeswitch.com
Web : www.tapeswitch.com

Tapeswitch GmbH

Postfach 10 20 23
Walter-Bruch-Straße 13
D-30982 Pattensen
Germany

Tel : +49 (0) 5101 14490
Fax : +49 (0) 5101 14499
Email : verkauf@tapeswitch.de
Web : www.tapeswitch.de

Tapeswitch Ltd

635 Newbold Street
London
Ontario
Canada
N6E 2T8

Tel : +1 519 681 2980
Fax : +1 519 685 9318
Email : sales@londonmat.com
Web : www.londonmat.com

Tapeswitch Japan

5-11-23 Nakakasai - Hirano Bldg.
Edogawa-ku,
Tokyo
Japan 134-0083

Tel : + 81 3 5676 5421
Fax : + 81 3 5676 5422
Email : tsjapan@gc4.so-net.ne.jp
Web : www.tsjapan.co.jp

CONTENTS

1. GENERAL

2. SYSTEM DESCRIPTION

2.1 CURTAIN

2.2 INDICATORS

3. INSTALLATION

3.1 GENERAL

3.2 SEPARATION DISTANCE

3.3 ELECTRICAL INSTALLATION

3.4 INITIAL CHECKING AND ALIGNMENT

4. PERIODIC CHECKING, SERVICING AND MAINTENANCE

4.1 PERIODIC CHECKING

4.2 SERVICING

4.3 MAINTENANCE

5. TECHNICAL SPECIFICATION

5.1 GS120 LIGHT CURTAIN SYSTEM

5.2 ORDER CODES AND MODEL NUMBERS

1. GENERAL

Guardscan GS120 light curtains and grids are through-beam photo-electric machine guarding devices, designed to protect operators working at or near dangerous machinery. They meet the requirements for EN61496 Type 2 light curtains and Category 3 safety control units as defined in EN954-1.

When correctly installed on a suitable machine, the system will detect a person (or part of a person) entering a dangerous area in the vicinity of the machine and will cause dangerous motion to cease before that person can reach a position where injury could occur.

Guardscan GS120 light curtains and grids use infra-red technology. A curtain of infra-red light is projected across the dangerous area. Intrusion into this curtain by a person, or part of a person, will be detected by the system. This will cause safety output signals to be generated which will stop the dangerous motion of the machine.

WARNING

The information in this manual relates to the use of the GS120 light curtain, to provide a basic safety switching device.

In some applications a GS120 light curtain may be used together with other Guardscan equipment to provide additional functions and features. The additional information necessary for the correct use of a GS120 light curtain when used with other Guardscan equipment is provided with the equipment concerned.

In such cases, some installation parameters, notably the mounting position of the light curtain in relation to the dangerous parts of the machine, can be affected and close attention must be paid to all the information supplied with all equipment.

2. SYSTEM DESCRIPTION

2.1 CURTAIN

A GS120 system consists of an arrangement of infra-red emitting devices, which send out pulses of infra-red light (emitter), and an arrangement of infra-red receiving devices, which detect the pulses (receiver). Both arrangements are identical in shape and size, and are enclosed in a robust extruded aluminium section with aluminium end covers.

The emitter and receiver units together generate a curtain of infra-red light between them. This curtain is mounted in such a position in relation to the dangerous parts of a machine that a person or part of a person approaching those dangerous parts must first penetrate the curtain. This penetration is detected by the light curtain system and, by means of its output switching devices, the light curtain system causes the dangerous parts to go to a safe state (e.g. by stopping moving parts) before the person can reach them.

IMPORTANT

From the above it can be seen that safe use of a light curtain relies not only on the safety integrity of the curtain itself but also on its proper mechanical and electrical interfacing to the machine.

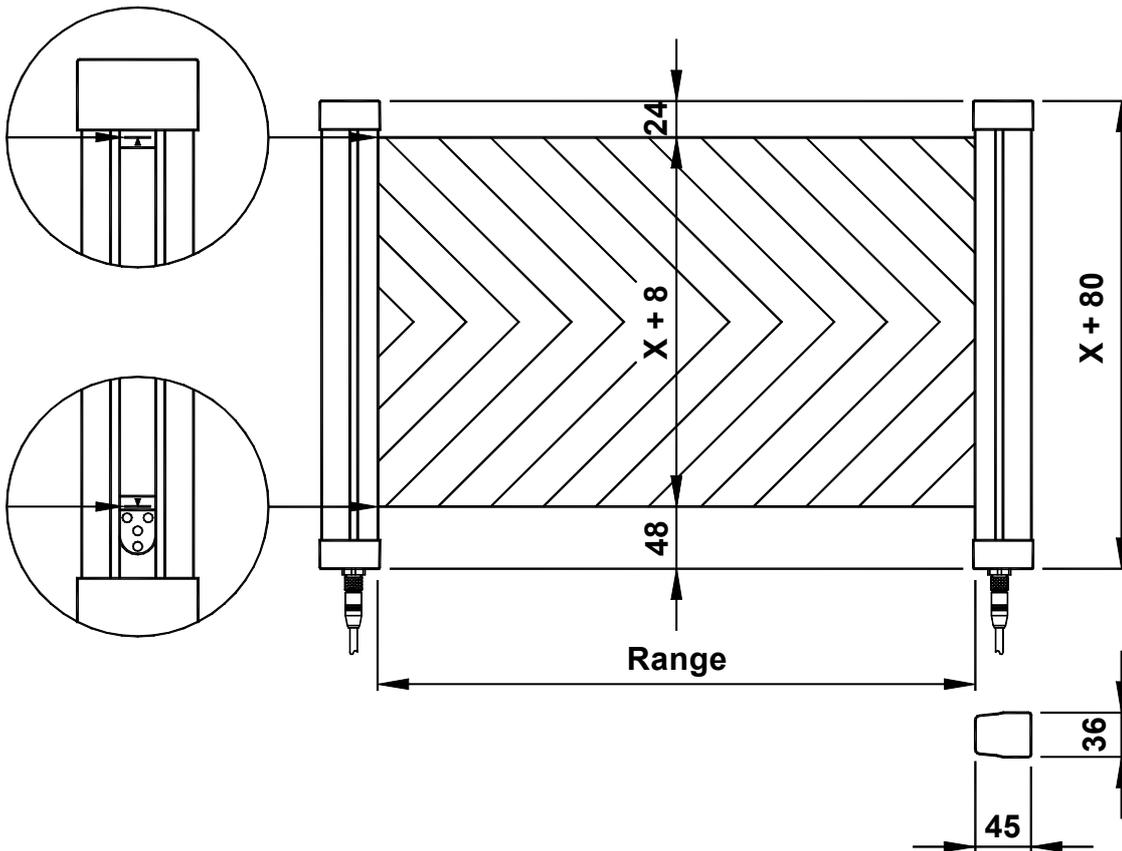
The safety integrity of the light curtain itself is the responsibility of Tapeswitch and the remainder of this section describes the features of the design by which safety integrity is ensured.

Proper mechanical and electrical interfacing is the responsibility of the user. Information for this purpose is provided in section 3 of this manual. The user should also refer to relevant application standards.

2.1.1 GS120 BASIC SYSTEM

The curtain dimensions are defined by the protected height and the range (i.e. the distance between the sender and receiver units). The protected height must be selected to suit the application.

All the dimensions relating to the curtain, for each detection characteristic of a basic GS120 system, (or basic slave) are shown in Figure 1. The upper and lower boundaries of the curtain are indicated by arrows on the front window labels of each unit.



X = Nominal curtain length (e.g. 200, 400, 600 etc.)

Figure 1

2.1.2 GS120 MULTI-BEAM SYSTEM

All the dimensions relating to the curtain, for each of the Multi-beam systems (or multi-beam slave systems) are shown in Figure 2.

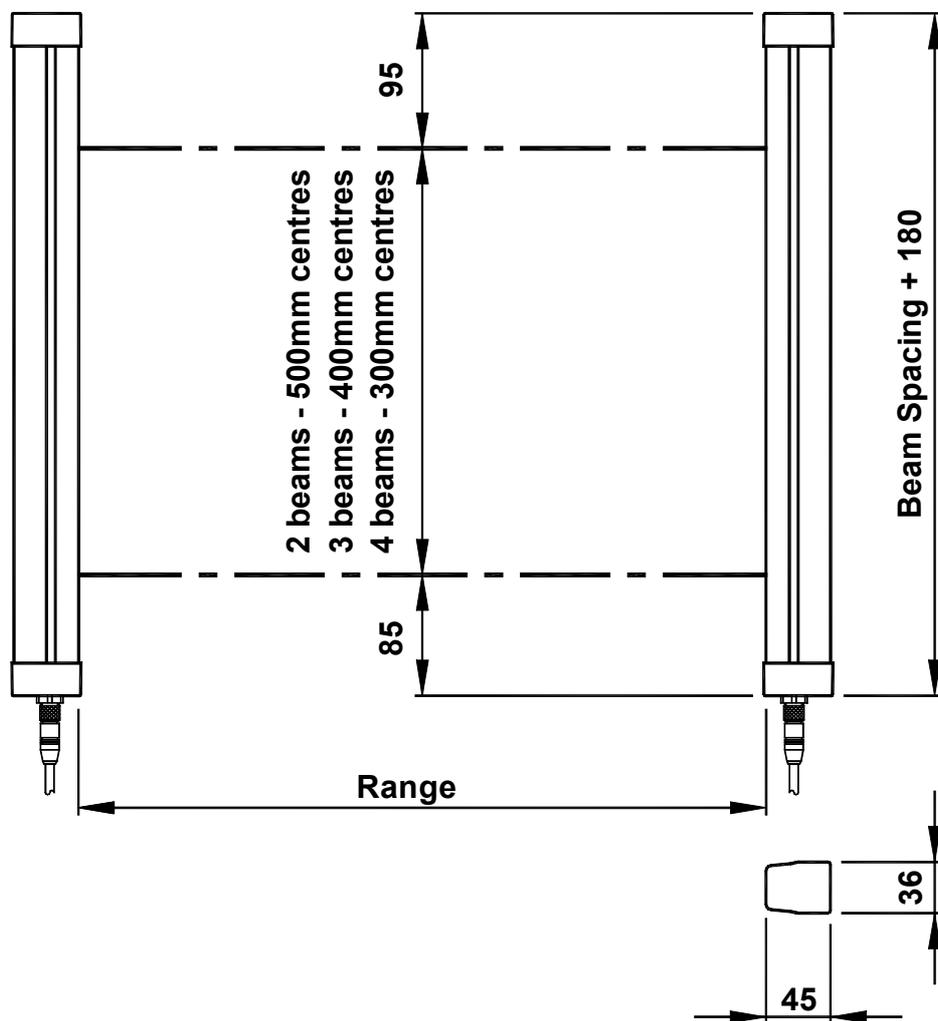


Figure 2

2.1.3 GS120 CASCADED SYSTEM

Additional flexibility to facilitate guarding in more than one plane is provided, by the capability to connect slave units to a basic or multi-beam master system.

The slave units can be basic, or multi-beam systems, with either of the defined detection characteristics of 30mm or 70mm.

The dimensions relating to the curtains, for each slave unit are as defined in the previous sections for each model. The upper and lower boundaries of each curtain are indicated by arrows on the front window labels of each unit.

A maximum of two slave units can be connected to a master system. Master and slave units can be assembled up to a maximum of 240 beams. Where:

30mm detection - 12 beams per 200mm curtain
 70mm detection - 4 beams per 200mm curtain

E.g. GS120 / M / 1000 / 30
 + GS120 / A / 0400 / 70
 = 68 beams

Note:

When master/slave columns have detection characteristics which have different range capabilities, these must be respected when systems are configured.

Important:

When master/slave columns have different detection capabilities the separation distance must be calculated and adhered to for each column separately.

Note:

When master/slave combinations are used, the total response time of the system is calculated by adding the response time of the master unit to the response time of the slave unit.

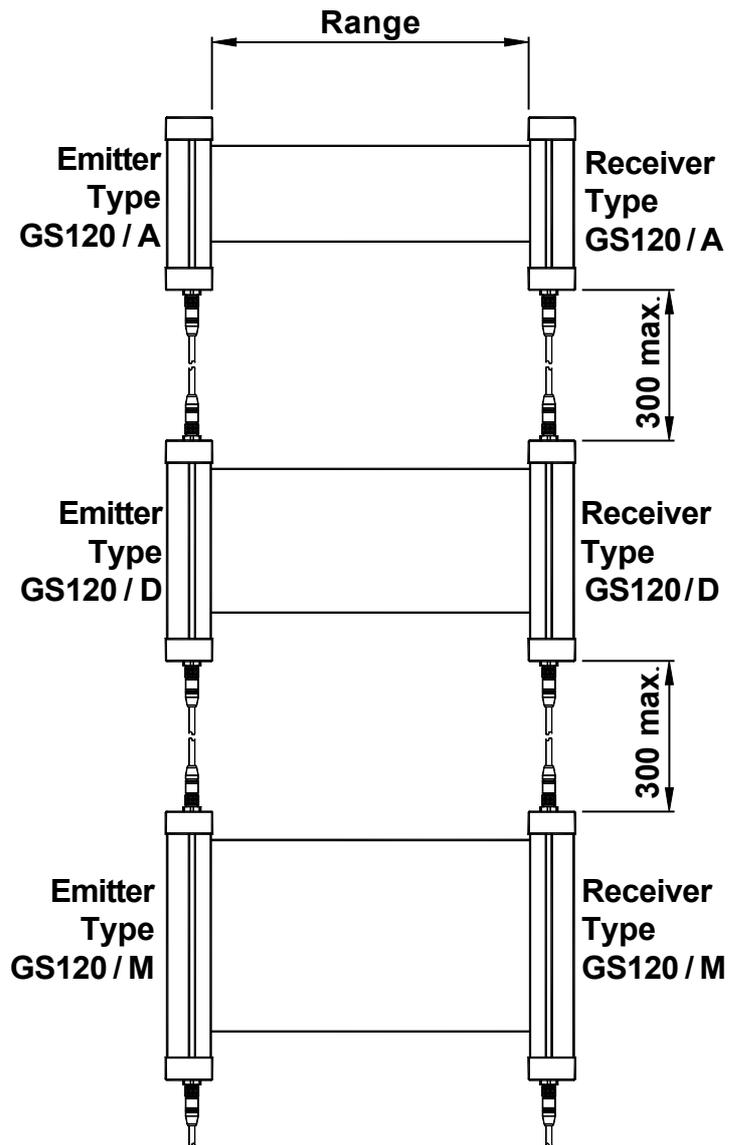


Figure 3

2.2 INDICATORS

2.2.1 LED OPTION

The standard/master receiver unit has four indicators as shown in Figure 4. The standard/master emitter unit has two indicators as shown in Figure 5. The slave emitter/receiver has one indicator as shown in Figure 6.

A description of each indicator is given in Table 1.

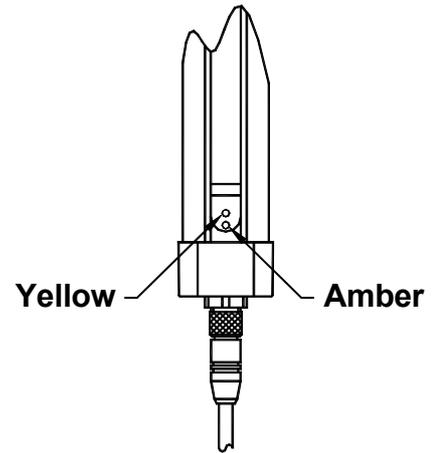


Figure 5

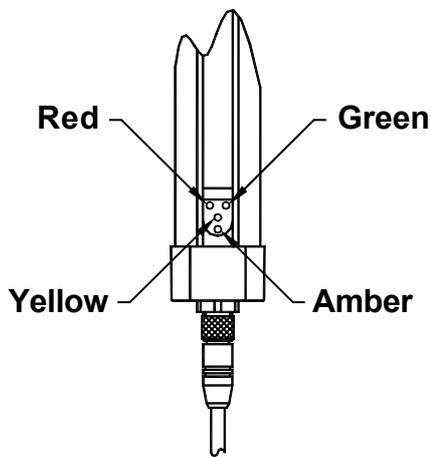


Figure 4

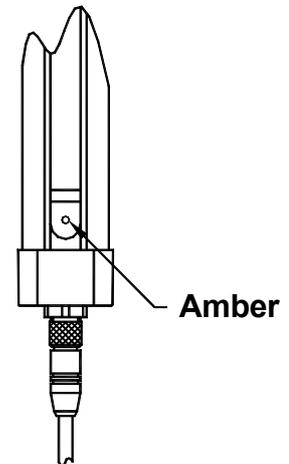


Figure 6

Unit	Colour	Description
Standard/ Master Emitter	Amber	Lit when power is connected to unit.
	Yellow	Lit steady when test input is applied. Lit flashing when emitter unit detects a problem.
Standard/ Master Receiver	Amber	Lit when power is connected to unit.
	Green	Lit when curtain is clear.
	Red	Lit when curtain is obstructed or when test input from emitter is applied.
	Yellow	Lit steady when receiver unit is waiting for a restart. Lit flashing when receiver unit detects a problem.
Slave Emitter	Amber	Lit when power is connected to unit.
Slave Receiver	Amber	Lit when power is connected to unit.

Table 1

2.2.2 DIAG OPTION

The LED indicators on the standard/master emitter unit and all slave units are the same as for the previous section (2.2.1). The receiver unit contains a scrolling 4-digit alphanumeric display for diagnostic purposes as shown in Figure 7.

The various displays and their meanings are shown in Table 2 below.

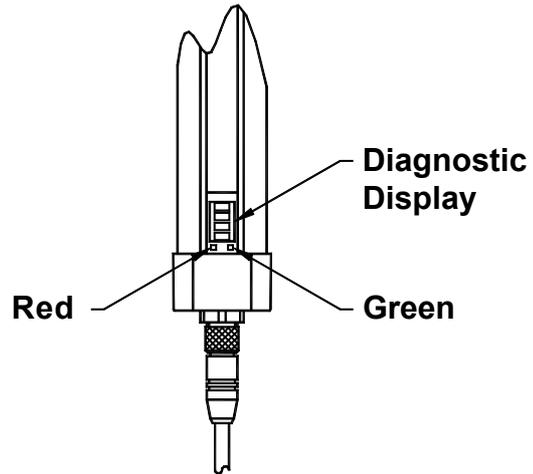


Figure 7

Displays in normal operation	
PNPA	PNP Auto restart mode
PNPM	PNP Manual restart mode
SSR	Volt-free relay mode
Waiting for EDM	In Auto restart mode, outputs are off because the feedback from external device monitoring is not present.
Waiting for Restart	In Manual restart mode, outputs are off because the restart signal has not been received
Bxxx	The curtain is obstructed and beam number xxx is the first beam broken

Faults with possible external causes	
Incomplete curtain	Shows that the timing signal from the last beam in the curtain is not being received. This would be displayed if, for example, a master curtain had no slave connected.
O/P A Hi	A possible short-circuit from Output A to +24Vdc
O/P A Lo	A possible short-circuit from Output A to 0V
O/P B Hi	A possible short-circuit from Output B to +24Vdc
O/P B Lo	A possible short-circuit from Output B to 0V

Internal Faults	
ERROR XX	Fault not serviceable in the field. Return to vendor for repair.

Table 2

3. INSTALLATION

3.1 GENERAL

WARNING

Guardscan GS120 systems are designed to protect operators working at or near dangerous machinery. They can only perform this function if they are correctly fitted and interfaced to a suitable machine. Those persons responsible for the machine must ensure that all persons involved in the installation of the photo-electric safety system have the necessary knowledge, training and experience and that they are fully aware of all laws, rules, regulations and codes of practice pertaining to their task.

EN999 gives guidance on the dimensions and positioning of photo-electric safety devices fitted to industrial machines. The main considerations are described below.

The attention of the installer is drawn to following general requirements for the installation of a GS120 system:

(a) The dangerous motion of the machine must be electrically controllable.

(b) The machine response/stopping performance must be adequate and consistent.

(c) It must be possible to stop the dangerous motion of the machine at any point in its operation, in any operating mode.

(d) The control system as a whole must be designed and constructed to provide the appropriate category of safety integrity as defined in EN954-1 'Safety of machinery: Principles for the design of safety related control systems'. The appropriate category should be as prescribed in the relevant C type EN standard for the type of machine concerned. In the absence of such a standard the appropriate category of safety integrity should be determined by performing a risk assessment as described in EN1050 'Safety of machinery: Risk assessment'.

(e) At power on, after a power interruption or after the curtain has been actuated, it must not be possible for the machine to start (or restart) until a manual control has been operated. This is known as "start/restart interlock". The GS120 can provide this function (See section 3.3.3) but if it is not installed, it must be provided elsewhere within the safety system

(f) Steps must be taken to prevent access to the dangerous parts of the machine from any direction not covered by the photo-electric curtain. Such steps could include fixed or interlocking fences or screens, additional photo-electric devices or pressure sensitive mats. Similar steps should be taken to prevent a person standing between the curtain and the dangerous parts.

3.1.1 MOUNTING BRACKET OPTIONS

(g) The correct minimum separation distance must be observed. The curtain must be mounted in the correct position in relation to the dangerous parts of the machine to take account of the stopping performance of the machine, the curtain format used and the detection capability of the curtain.

(h) The curtain must be of sufficient height such that access to the dangerous parts, from the direction of approach of the operator, is only possible by obstructing the curtain taking into account all possible operator positions.

(i) No devices other than those specified in this manual should be connected to the internally generated power supply of the system.

(j) After installation the machine/guard system must be commissioned in accordance with the requirements of section 4.1.1 of this manual.

(k) Any covers removed during installation must be replaced as soon as possible.

(l) To avoid nuisance tripping, if a **fluorescent lamp with an electronic ballast** is fitted within 1,5 metres of the receiver unit it must be fitted outside a 20° field of view from the receiver unit ($\pm 10^\circ$ about the centre line). If this is not practical, a mains frequency fluorescent light fitting should be used.

There are 3 types of mounting bracket options available for the GS120 Systems:

3.1.1.1 MOUNTING BRACKET TYPE AB

The adjustable mounting bracket - Type AB combines a robust design with quick release facility, the adjustable bracket promotes speedy installation and also allows for easy interchange of a light curtain unit without the need for re-alignment. This option is specified as 'AB' in the order code.

3.1.1.2 MOUNTING BRACKET TYPE CB

The Clamp Bracket - Type CB offers a neat and compact design to provide versatile installation. In addition, the Clamp Bracket Mounting Plate has been specially designed to allow angular adjustment of the light curtain. This option is specified as 'CB' in the order code.

3.1.1.3 MOUNTING BRACKET TYPE EB

The Endcap Bracket - Type EB is designed to be used in situations where space is limited, the slimline nature of the Endcap Bracket allows the light curtain to be easily mounted in a confined space such as on the external edge of a fixed structure or adjacent to a floor post. This option is specified as 'EB' in the order code.

For installation instructions regarding these mounting bracket options please see the installation sheets supplied with each kit.

3.1.2 OPTICAL ALIGNMENT

The emitter and receiver units should be mounted facing each other at the same height with their axes aligned. Misalignments as illustrated in Figure 8 should be avoided.

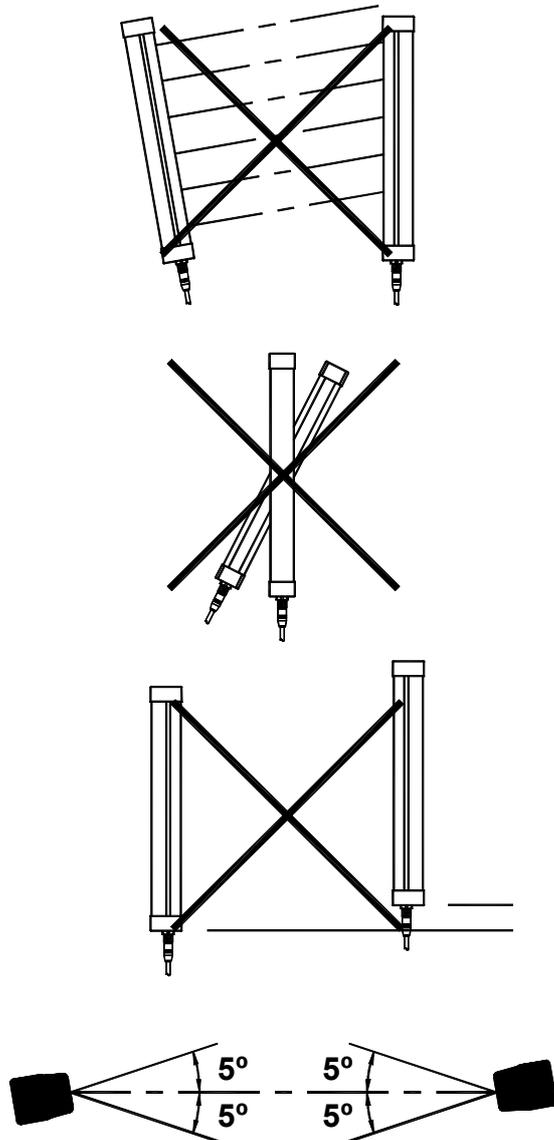


Figure 8

3.1.3 REFLECTIVE SURFACES

There should be no reflective surfaces within the 'field of view' of the curtain units. Reflective surfaces within the field of view can lead to non-detection of an obstruction. The field of view of each of the emitter and receiver units is approximately 5 degrees either side of the optical axis.

A minimum distance from the optical axis to any reflective surface must be observed. This distance depends on the actual operating distance and must take into account possible misalignment. This is illustrated in Figure 9. The distance should be determined as follows:

Operating distance $L < 3\text{m}$: $X > 260\text{mm}$

Operating distance $L > 3\text{m}$: $X > 0.0874L\text{mm}$

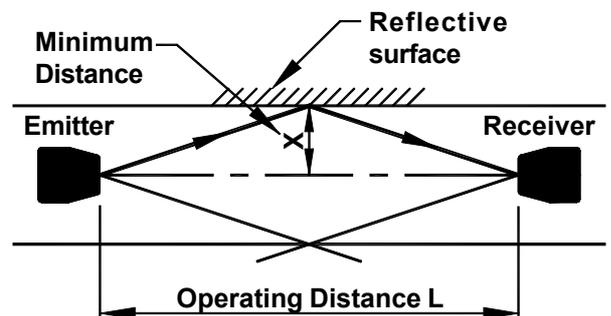


Figure 9

3.1.4 SYSTEMS IN CLOSE PROXIMITY

In order to avoid nuisance interference between adjacent systems, whenever two sensing units are used within each other's sensing range, ensure that the front window of any unit is not within the field of view of units of the opposite type from other systems.

This can be achieved by ensuring that units of the same type are mounted facing in opposite directions. See Figure 10.

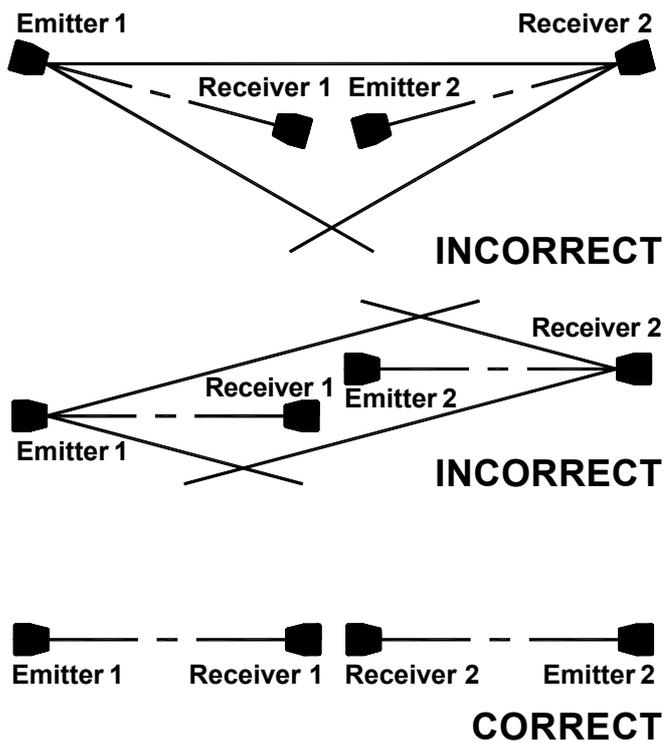


Figure 10

3.2 SEPARATION DISTANCE

Any machine, regardless of the efficiency of its braking system, will take a certain time to come to rest after a stop signal is generated.

The time from the instant that the curtain is broken to the instant that dangerous motion actually ceases is called the overall system response time. The dangerous parts will obviously continue to move during this time. The curtain must therefore be positioned at a certain minimum distance from the dangerous parts to prevent a person who has obstructed the curtain from reaching the dangerous parts before they have stopped.

This distance is the minimum separation distance and is defined as the distance, in the direction of approach, between the physical point at which the curtain detects an obstruction and the nearest dangerous parts.

EN999 provides guidelines on how to determine the minimum separation distance for a given application.

Figure 11 provides a methodology for determining the separation distance of a GS120 system, which is as follows:

- (a) Identify the hazards and assess the risks (see EN292-1 and EN1050).
- (b) If a type C standard exists for the machine, use the distance specified by that standard.
- (c) If there is no type C standard, or if the C standard does not specify a minimum distance, then use the formulae in EN999 (reproduced in the following sections) to calculate the separation distance.
- (d) Incorporate the distance in the machine design.
- (e) Ensure that the device has been installed in such a manner that access to the danger zone is not possible without detection.
- (f) If the positioning of the curtain allows persons to be in a position between the curtain and the danger zone, supplementary measures may be required depending on the risk.

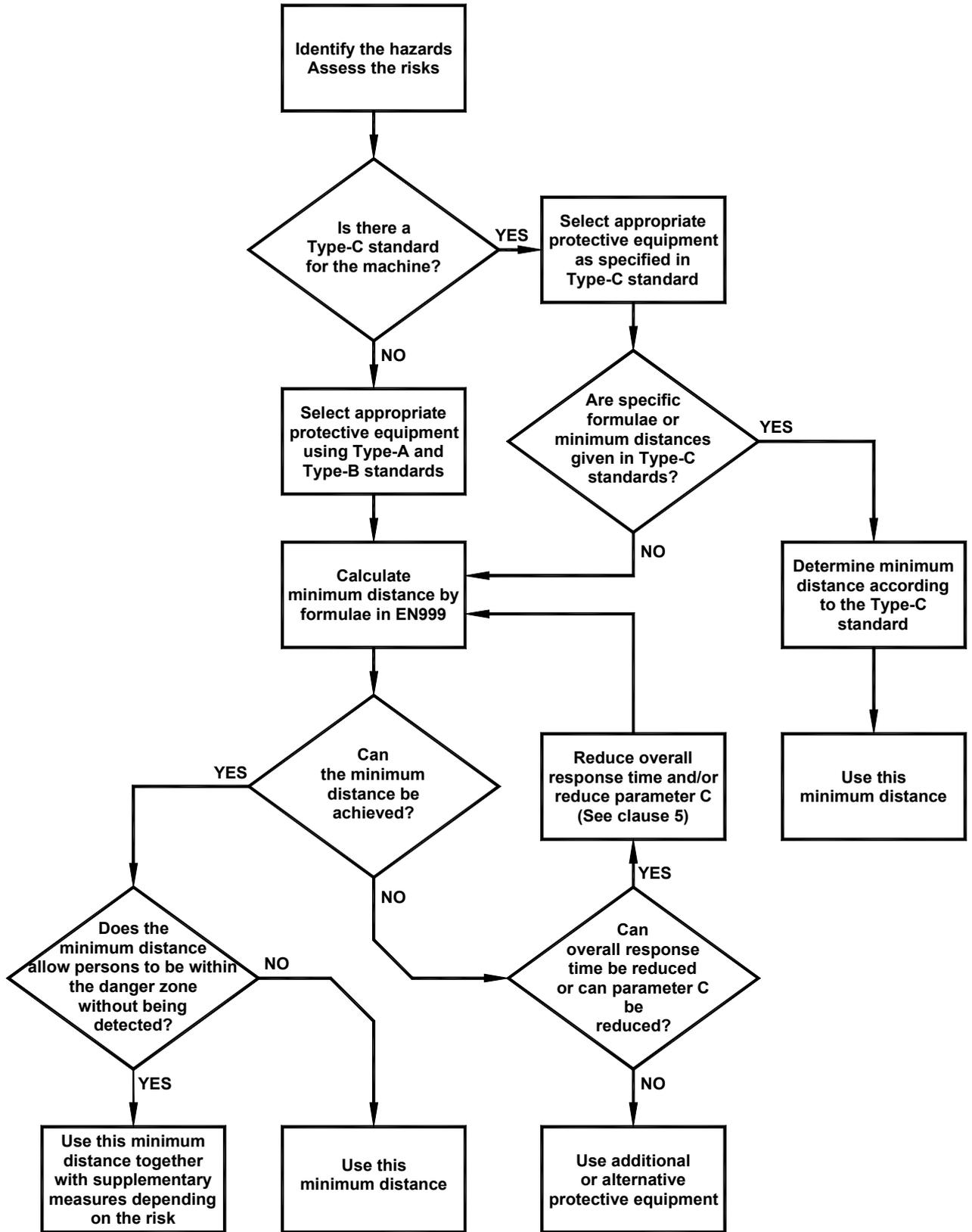


Figure 11

3.2.1 GS120 SYSTEMS

The separation distance depends on the application and the following factors:

- the curtain format used.
- the detection capability, d .
- the overall system response time, T .
- the curtain penetration figure, C .
- the derived body part speed, K .

The overall system response time, T , is a period, in seconds, given by the sum of the response times of the safety device and the machine control system. The response time of the GS120 system is between 20ms and 44ms. (See section 5.1 for specific data). The response time of the machine control system should be measured using a suitable device and the highest value recorded, plus a suitable allowance for brake deterioration, should be used in the calculation of the minimum separation distance. It is recommended that the overall system response time is recorded on the machine information label or plate.

The curtain penetration figure, C , is a distance, in millimetres, representing the distance by which part of a person penetrates the plane of detection of the safety device before actuation of the sensing unit occurs. This figure is a function of the detection capability.

The derived body part speed, K , is a speed, in millimetres per second, derived from measurement data of speeds of movement of various parts of the human body. This figure represents the derived speed of that part of the body which will obstruct the sensing unit.

The minimum separation distance should be recorded on the machine information label or plate.

The general formula for calculating the minimum separation distance, S , in millimetres, for GS120 light curtains is as follows:

$$S = K \times T + C$$

3.2.1.1 NORMAL APPROACH

Normal approach format is shown in Figure 12. For normal approach format the inner edge of the front window of each unit (i.e. the edge which is nearest to the machine) should be considered to be the point at which an obstruction is detected. See plane X in Figure 12.

(a) For a normal approach application where the curtain has a detection capability, d , of $\leq 40\text{mm}$:

$$S = K \times T + C$$

where $K = 2000$ and
 $C = 8(d - 14)$, but not less than 0;

If this formula gives S greater than 500mm then S can be recalculated $K = 1600$ but in this case S must not be less than 500mm.

If it is foreseeable that the guard will be used in a non-industrial environment, eg, in the presence of children, the minimum distance shall be increased by at least 75mm and a body part speed of 2000mm/s must be used.

(b) For detection capability, d, of 30mm:

(c) For detection capability, d, of 70mm
(when d is greater than 40, C = 850):

$$S = K \times T + C$$

$$S = K \times T + C$$

where $K = 2000$ and
 $C = 8(d-14)$

where $K = 1600$ and
 $C = 850$

i.e. $S = (2000 \times T) + 128$

i.e. $S = (1600 \times T) + 850$

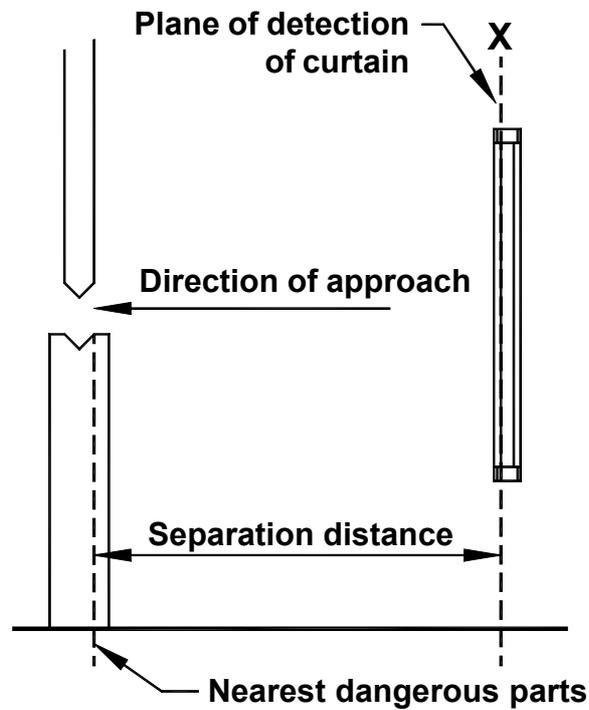


Figure 12

3.2.1.2 PARALLEL APPROACH

Parallel approach format is shown in Figure 13. For parallel approach format the outer curtain detection limit (as shown on the front window of each unit) minus the detection capability, should be considered to be the point at which an obstruction is detected. See Plane X in Figure 13.

$$S = K \times T + C$$

where $K = 1600 \text{ mm/s}$
 $C = 1200\text{mm} - 0.4H$, but not less than 850mm, where H is the height of the detection zone above the reference plane, in mm.

i.e. $S = (1600 \times T) + 1200 - 0.4 \times H$

For this type of protective equipment, the height H of the detection zone shall not exceed 1000mm. If H is greater than 300mm (200mm for non-industrial applications), the risk of undetected access beneath the detection zone shall be considered.

The lowest allowable height of the detection zone shall be calculated using the formula:

$$H = 15(d - 50\text{mm}).$$

Therefore, for a given height of the detection zone, the detection capability, d, is:

$$d = H/15 + 50\text{mm}$$

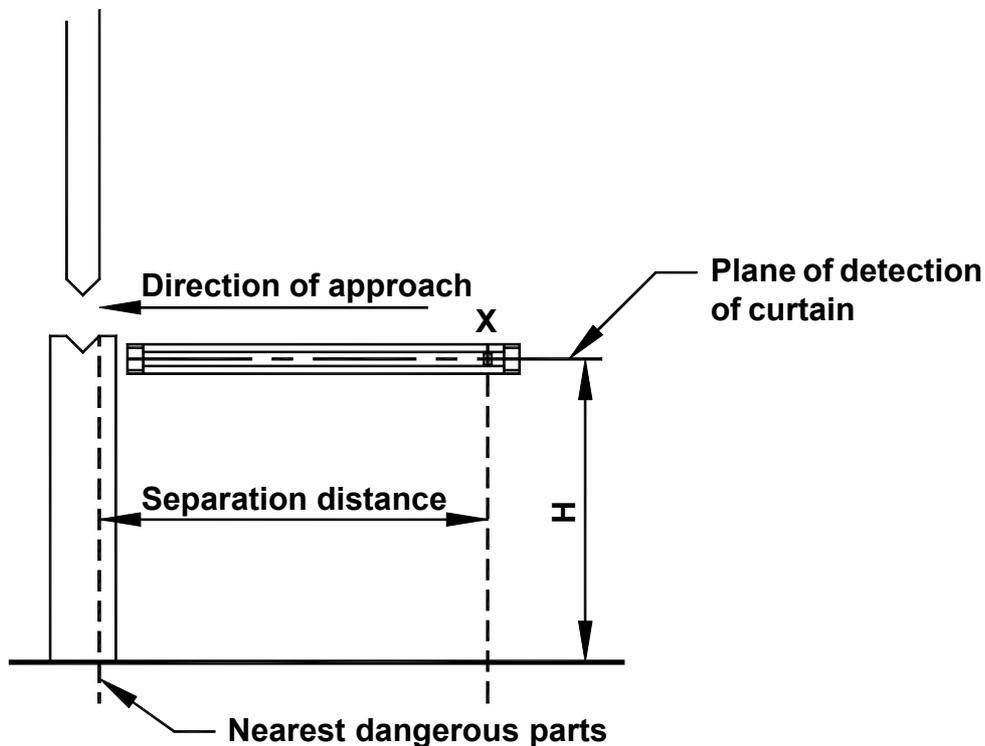


Figure 13

3.2.1.3 ANGLED APPROACH

If it is necessary to install the curtain, at an angle to the direction of approach as shown in Figure 14, then the following requirements apply:

An angle within $\pm 5^\circ$ of normal or horizontal, need not be considered to be angled, and the relevant formula used.

For detection zones which are positioned at angles greater than $\pm 5^\circ$, to the direction of approach, account shall be taken of the risks associated with the direction of approach, and the most appropriate formula used.

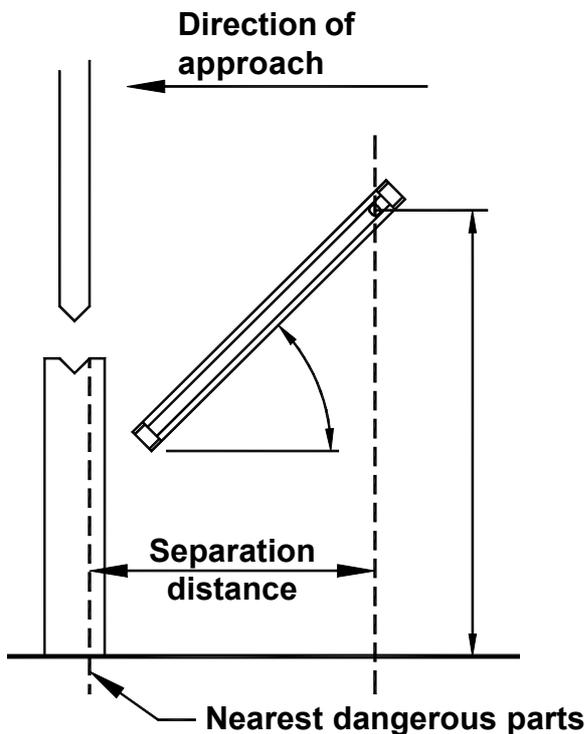


Figure 14

3.2.1.4 APPROACH TO 'L' INSTALLATION

If vertical and horizontal master/slave GS120 light curtains are used together as in Figure 15, where the vertical curtain is the main trip curtain and the horizontal curtain performs presence sensing inside it, the separation distance calculations for the vertical curtain are used. However, the detection capability calculations of the horizontal curtain with respect to its height should also be observed.

Note: Where master/slave combinations are used:

$$\begin{array}{rcl} \text{Total} & & \text{Master Unit} & \text{Slave Unit} \\ \text{Response} & = & \text{Response} & + \text{Response} \\ \text{Time} & & \text{Time} & \text{Time} \end{array}$$

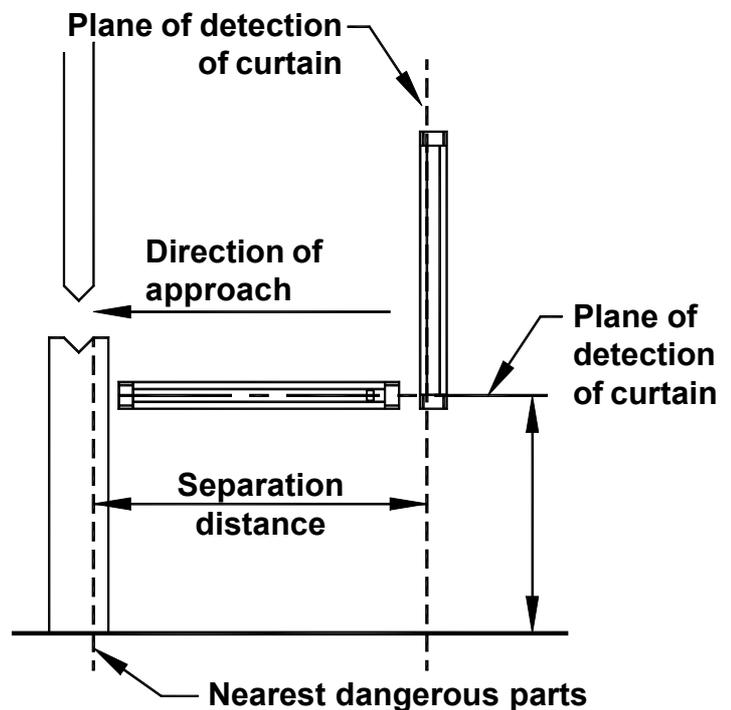


Figure 15

3.2.1.5 POSITIONING OF GS120

EN999 gives guidance on the dimensions and positioning of photo-electric safety devices fitted to industrial machines. The main considerations are described below and are illustrated in figure 16.

(a) The appropriate protected height must be selected. The curtain must be of sufficient height such that access to the dangerous parts, from the direction of approach of the operator, is only possible by obstructing the curtain taking into account all possible operator positions.

(b) The correct minimum separation distance must be observed. The curtain must be mounted in the correct position in relation to the dangerous parts of the machine to take

account of the stopping performance of the machine, the curtain format used and the detection capability of the curtain.

(c) Steps must be taken to prevent access to the dangerous parts from any direction not covered by the curtain and prevent an operator from standing between the curtain and the dangerous parts without obstructing the curtain. Additional mechanical guarding will usually be necessary to achieve this.

The physical parameters affecting the positioning are the dimensions of the detection zone of the light curtain (i.e. the protected height and the range) and the minimum separation distance. These are described in the following sections.

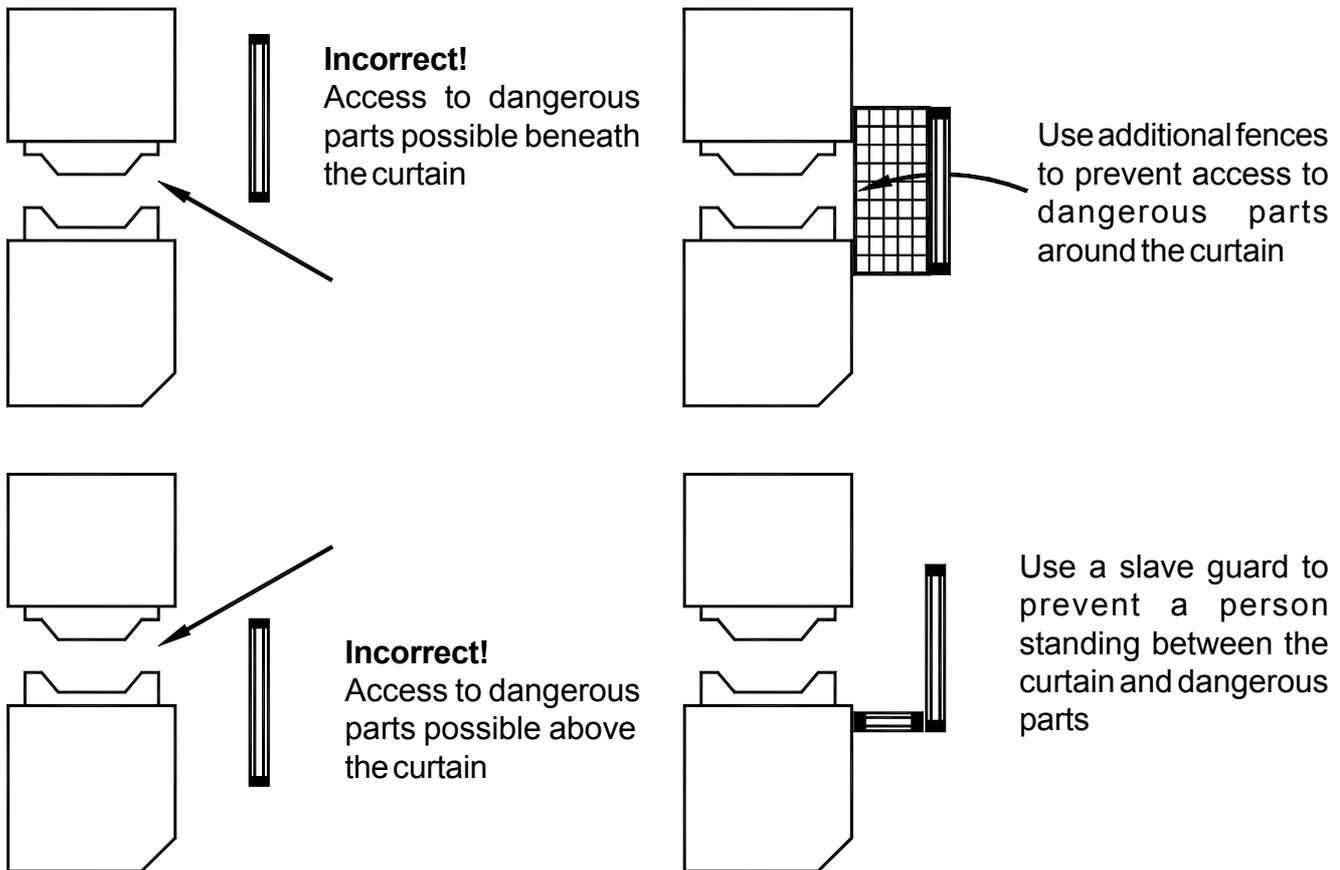


Figure 16

3.2.2 GS120 MULTI-BEAM SYSTEM

The separation distance depends on the application and the following factors:

- the curtain format used.
- the overall system response time, T.

The overall system response time, T, is a period, in seconds, given by the sum of the response times of the safety device and the machine control system. The response time of the GS120 multi beam system is 20ms in all cases. The response time of the machine control system should be measured using a suitable device and the highest value recorded, plus a suitable allowance for brake deterioration, should be used in the calculation of the minimum separation distance. It is recommended that the overall system response time is recorded on the machine information label or plate.

The minimum separation distance should be recorded on the machine information label or plate.

The calculations for minimum separation distance, S, in millimetres, for GS120 Multi-beam light curtains used in normal format are as follows:

$$S = (1600\text{mm/s} \times T) + 850\text{mm}$$

the system has to be mounted with the bottom beam set at a height from the floor as shown:

GS120/2:	400mm
GS120/3:	300mm
GS120/4:	300mm

3.2.3 MULTI-SIDED GUARDING

By using mirror columns the beams can be deflected around corners to form two and three sided guard configurations. It should be borne in mind that for each mirror used the range is reduced by approximately 20%. Also the alignment of systems with mirrors can be difficult especially where the mounting surfaces are uneven. It is therefore recommended that no more than two mirrors are used between any pair of emitter and receiver units. See Figures 17 and 18.

Note: The arrangement shown in Figure 19 is not recommended, as it is very difficult to determine that the safety distance S is correct.

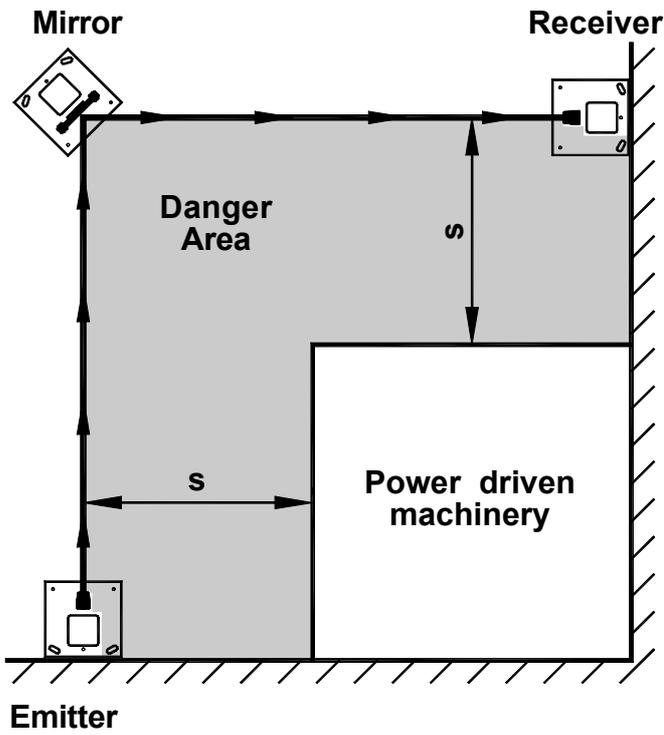


Figure 17 - Guarding a two sided area

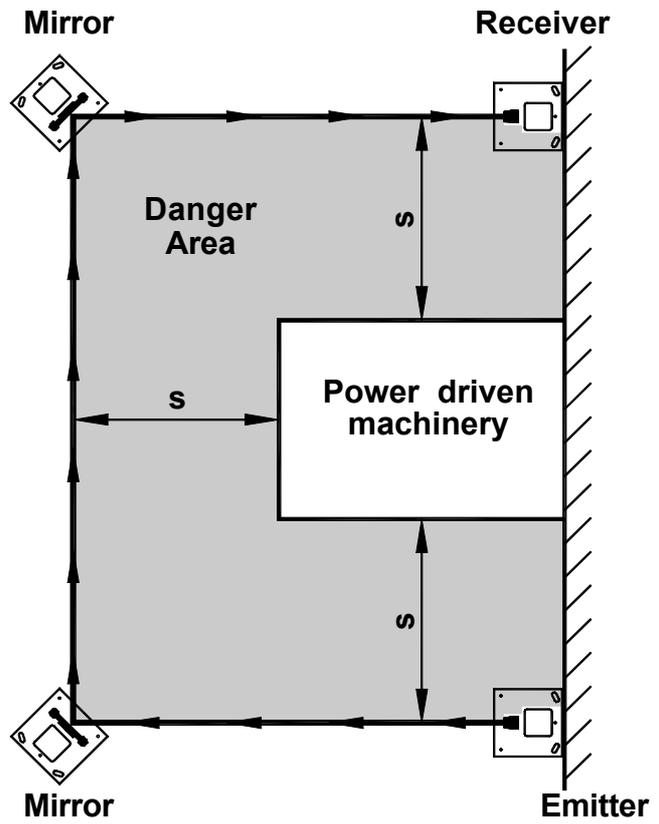


Figure 18 - Guarding a three sided area

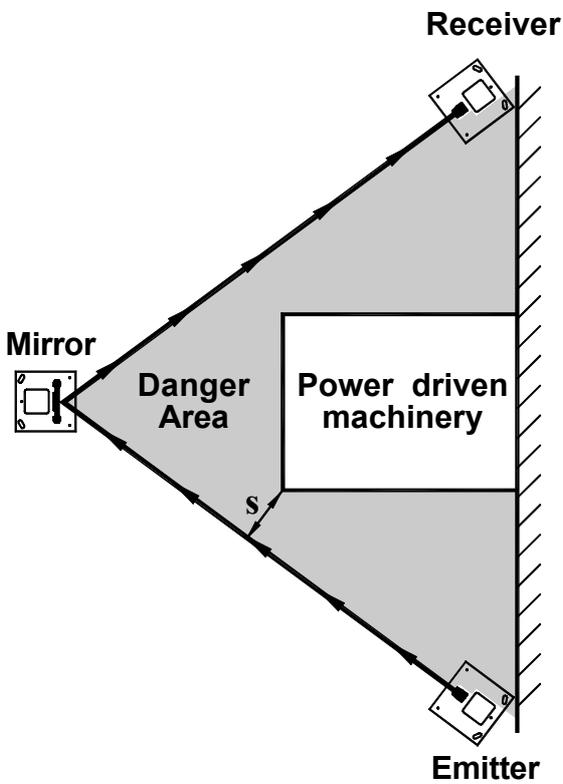


Figure 19 - Incorrect use of two sided guarding

3.3 ELECTRICAL INSTALLATION

3.3.2 TEST INPUT

3.3.1 GENERAL

Both units must be supplied with 24V d.c. $\pm 20\%$. This d.c. supply must be an isolated supply from a safety transformer which meets the requirements of IEC61558-2-6 and which can maintain a minimum of 18V d.c. output during a 20ms dip in the mains supply. The -ve side of this supply should be earthed, and the cables should be routed separate from power/motor drives.

IMPORTANT

The screen is to be connected to the system PE in the control cabinet.

If the moulded connection cable is to be extended, screened cable is to be used with a minimum wire cross sectional area of 0,5mm². Care must be taken to ensure that the continuity and protection provided by the screen is maintained.

The power consumption is dependant on the protected height of the system but is less than 12VA.

3.3.2 EMITTER UNIT

3.3.2.1 GENERAL

The emitter unit uses five terminals, two for the d.c. supply, two for the test input (see 3.3.2.2) and one for the protective earth, as shown in Figure 20.

On some machines a test input is used to check the interface between the photo-electric safety device and the machine. The input simulates the obstruction of the curtain in order to cycle the output relays and thereby expose any fault before the next machine cycle. This input is applied during a safe part of the machine cycle or at the end of the cycle.

If this function is used a normally closed contact should be connected as shown in Figure 20.

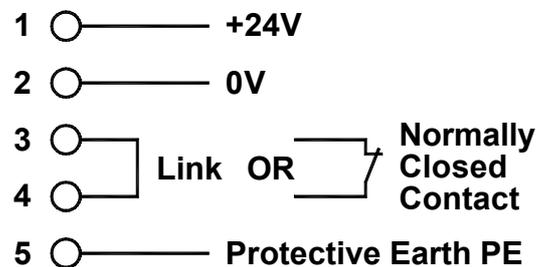
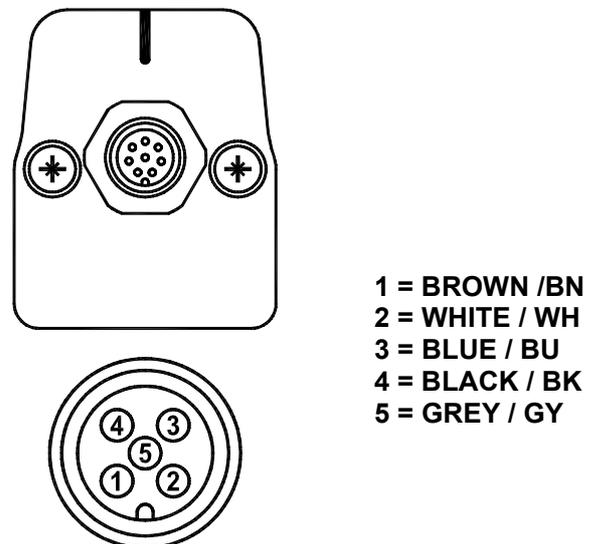


Figure 20 - Emitter Unit Connections

3.3.3.2 PNP VERSION

This contact must open for a minimum of 100ms. When this contact is opened the light curtain safety outputs will be switched off and will remain off until the test contact closes again and the curtain self-tests have been successfully performed (assuming that the curtain is not obstructed).

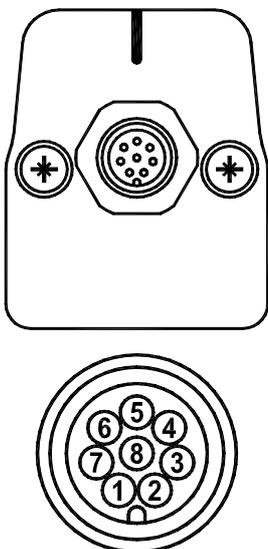
If test input is not used then these terminals should be linked together.

3.3.3 RECEIVER UNIT

3.3.3.1 GENERAL

The GS120 is available with two output modes, PNP and SSR, as shown in the order code. The PNP version has cross-monitored 24Vdc PNP outputs, start/restart interlock and the ability to monitor contacts from external devices (EDM). The SSR version has volt-free contacts which are closed when the curtain is clear, but does not have any start/restart interlock function. This must be provided elsewhere in the safety system.

The 24Vdc supply must have a 2A quick blow in-line fuse fitted.



- 1 = WHITE / WH
- 2 = BROWN / BN
- 3 = GREEN / GN
- 4 = YELLOW / YE
- 5 = GREY / GY
- 6 = PINK / PK
- 7 = BLUE / BU
- 8 = RED / RD

Figure 21 - Receiver Unit Connector

3.3.3.2.1 SAFETY OUTPUTS

The unit has two 24Vdc PNP outputs. The two output signal switching devices (OSSDs) should be wired to independent switching devices in the machine control circuit. The OSSDs are solid-state devices and are monitored and short-circuit protected.

The maximum current is 0.1A

The output voltage, U_A , of each OSSD is dependent on the supply, U_V , and the load which is given by the following expression:

$$U_A > U_V - 2V$$

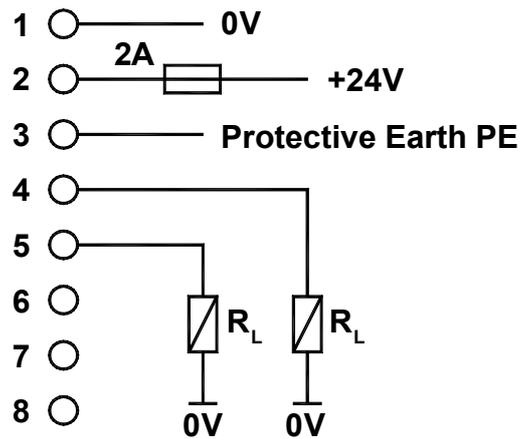


Figure 22 - PNP Version Safety Outputs

3.3.3.2 START/RESTART AND EXTERNAL DEVICE MONITORING (EDM)

In the PNP mode the GS120 can be used as a manual or automatic start/restart system. The function is determined by the connections to the unit. In manual mode, the outputs will only switch on when the curtain is clear and a reset switch is closed and then opened. In automatic mode the outputs will be on whenever the curtain is clear and off whenever the curtain is obstructed.

The GS120 also has the ability to monitor external devices. This is achieved by using normally-closed contacts of the external device and monitoring that they are closed before allowing the outputs to switch from off to on. The possible configurations are shown in Figures 23 to 26.

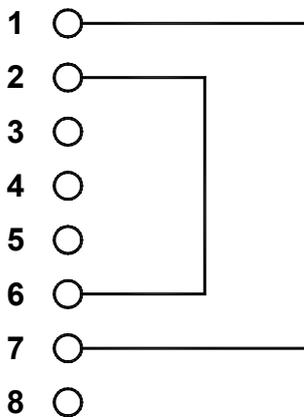


Figure 23 - Auto Restart

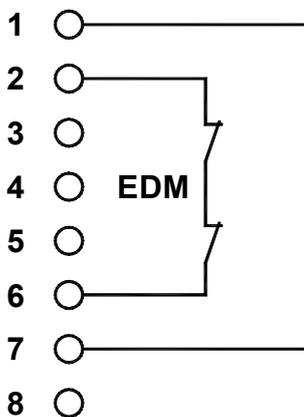


Figure 24 - Auto Restart with EDM

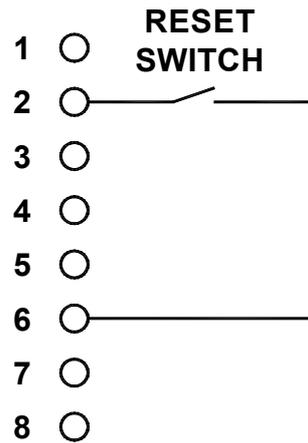


Figure 25 - Manual Restart

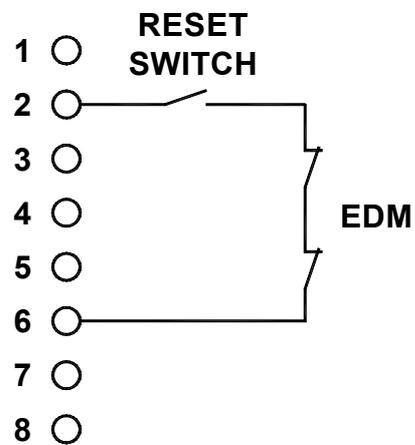


Figure 26 - Manual Restart with EDM

3.3.3.3 SSR VERSION

The unit has two volt-free solid-state outputs. It operates in automatic mode and so the outputs will be on whenever the curtain is clear and off whenever the curtain is obstructed. See Figure 27.

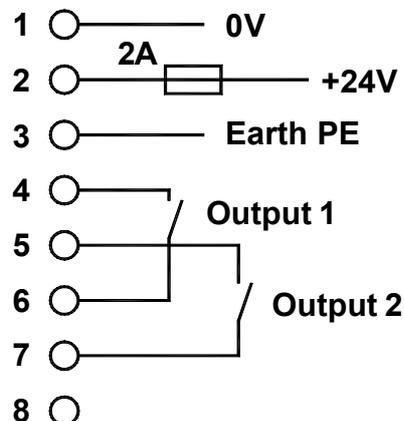


Figure 27 - SSR Version Safety Outputs

3.3.4 INTERFACING TO A MACHINE

The interfacing of a light curtain to a machine can be achieved by using discrete components or by means of an interface unit such as the Guardscan SRUB or the Pilz PNOZ 8.

All the relays shown are safety relays with positively guided contacts. If this circuit is implemented using discrete components it is essential that this type of relay is used.

3.3.4.1 PNP VERSION MANUAL RESET

It may be possible to connect the GS120 directly to the Machinery Primary Control Elements (MPCE). The GS120 provides the Start/Restart function necessary to avoid unintended initiation of the machine.

Note N/C contacts of K1 and K2 are used for monitoring purposes. If EDM is carried out elsewhere the reset switch should be connected between pin 2 and pin 6 of the Receiver unit.

IMPORTANT

A number of manufacturers produce units containing circuits of this type. Care should be taken to ensure that the inputs of these units can accept the PNP outputs of the light curtain.

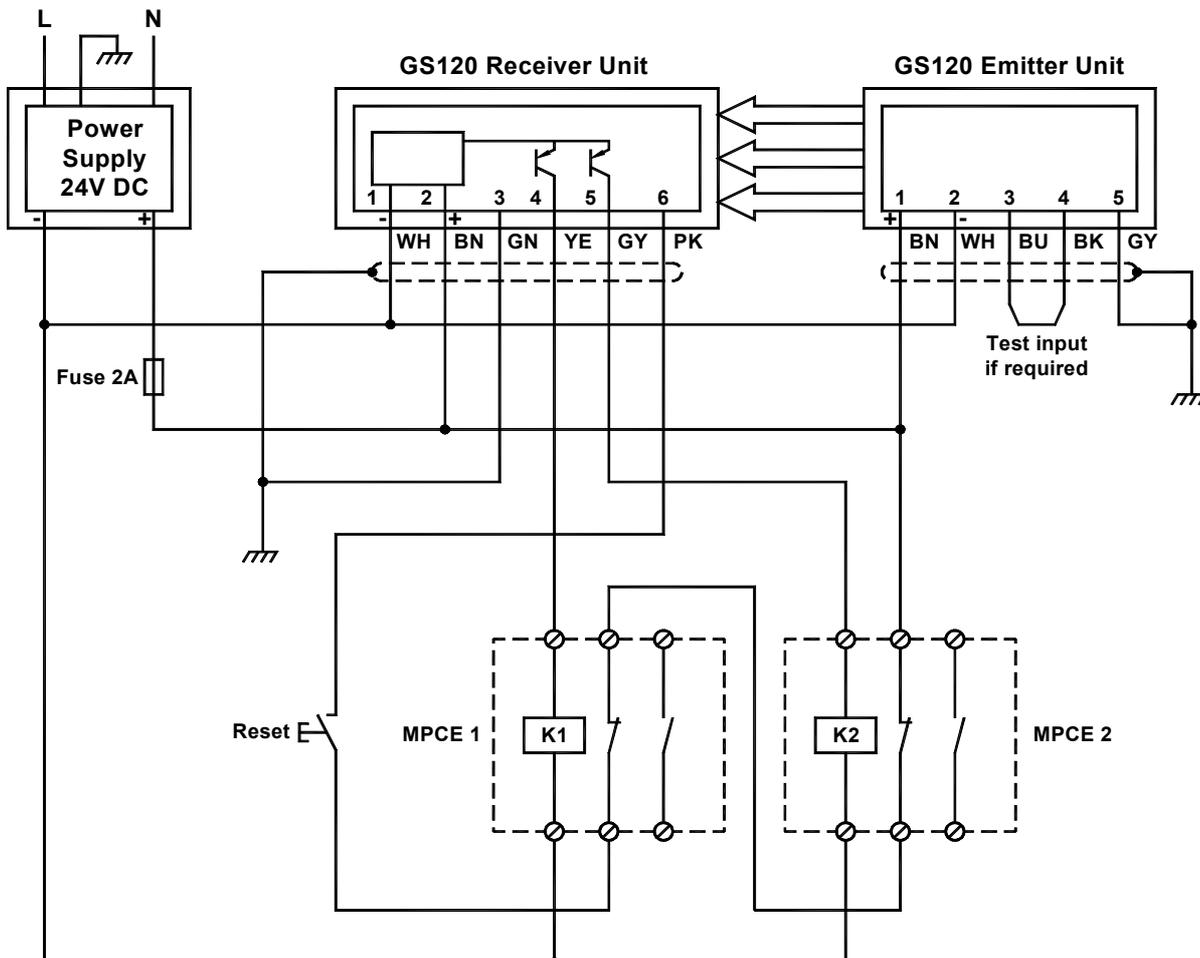


Figure 28

3.3.4 PNP VERSION AUTO RESET

The GS120 can be used in Auto Restart mode. If this mode is selected, the Manual Restart function must be provided elsewhere in the machine safety control system (for example, in the SRUB interface unit).

Note: The connection through 41 and 42 is used for external monitoring (EDM). If an alternative safety relay is used which does not have N/C contacts for monitoring, then connect pin 2 to pin 6 on the Receiver unit.

IMPORTANT

A number of manufacturers produce units containing circuits of this type. Care should be taken to ensure that the inputs of these units can accept the PNP outputs of the light curtain.

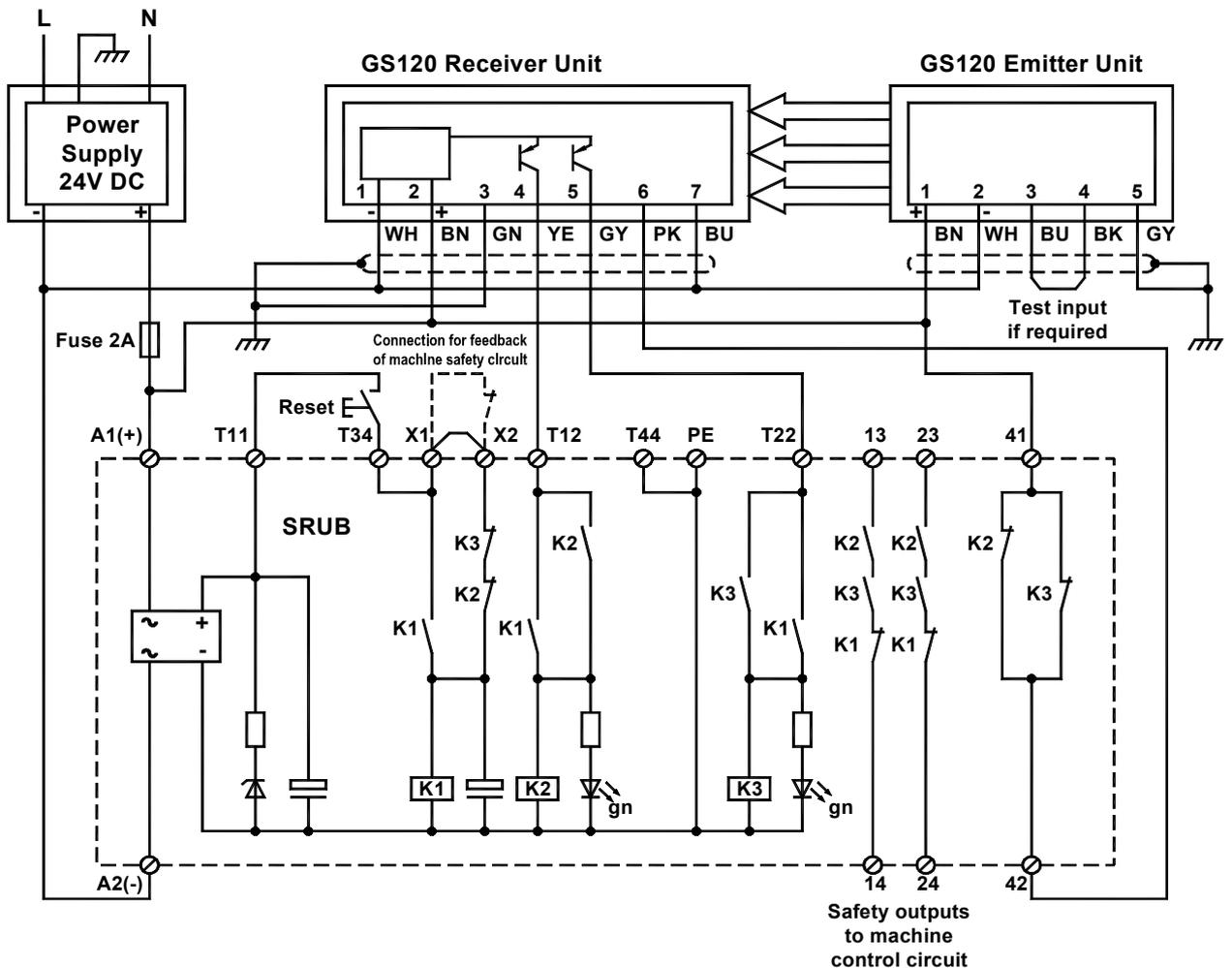


Figure 29

3.3.4.3 SSR VERSION

The interfacing of a GS120 light curtain to a machine can be achieved by means of an interface unit such as the Pilz PNOZ 8. The circuit diagram for the PNOZ 8 and the typical connections to the GS120 light curtain and the machine are shown in Figure 30 below.

IMPORTANT

A number of manufacturers produce units containing circuits of this type. Care should be taken to ensure that the inputs of these units can accept the volt-free outputs of the light curtain, and that the outputs of the light curtain are wired with one channel "pull up" and one channel "pull down" so as to maintain the failure mode integrity.

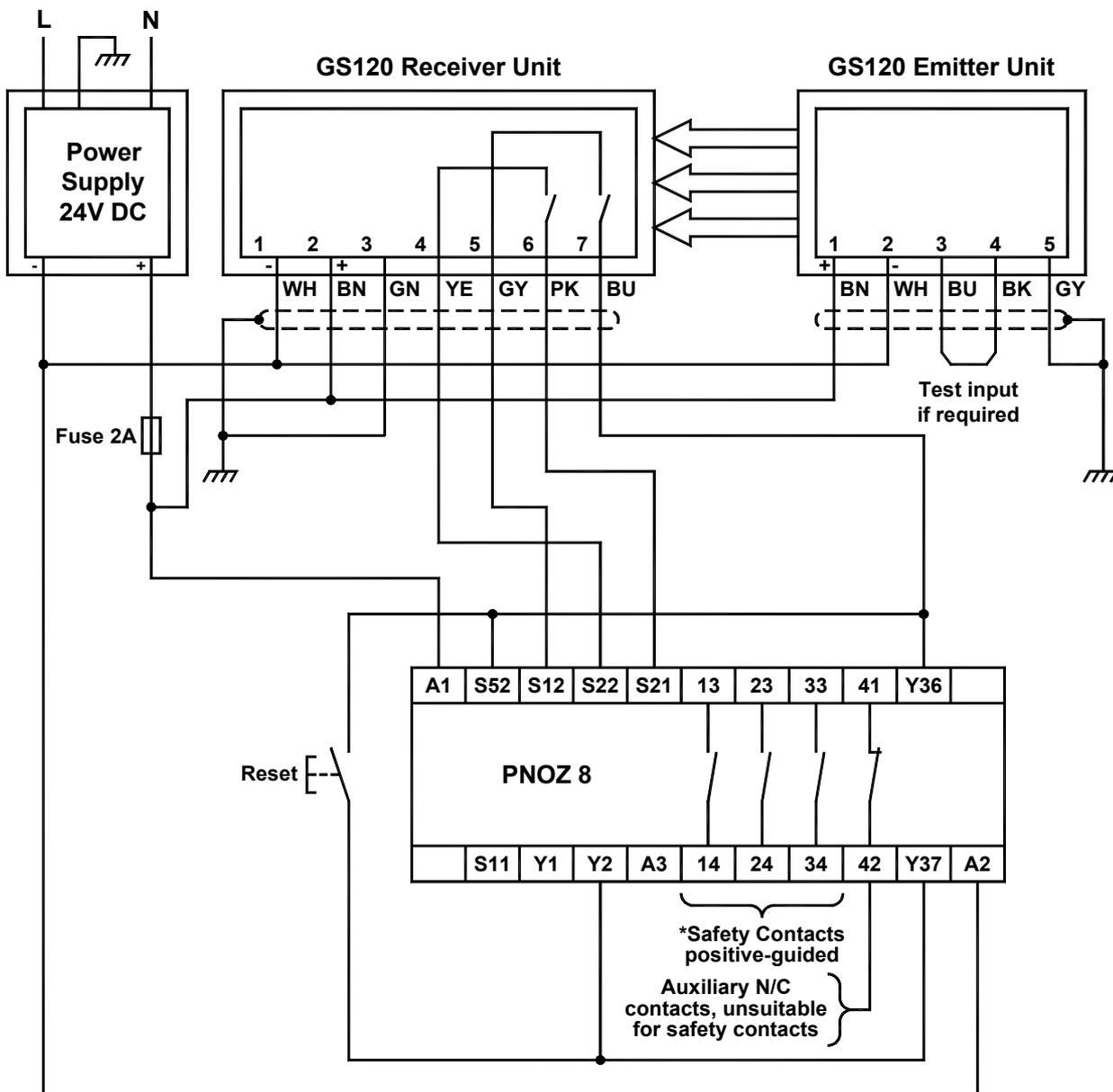


Figure 30

3.3.5 CONNECTIONS TO AS-i SYSTEM

The connection of a GS120 system to an AS-i Safe system is accomplished as shown in Figure 31 below, using standard AS-i Safe I/O modules.

The connection of the Emitter and Receiver units to the system is simply achieved by plugging into standard AS-i components using the cables supplied.

Note: The power supply leads of the GS120 system should not be connected directly to the YELLOW AS-i cable as this may cause AS-i data transmission problems. It is recommended that this connection be made using a decoupling network.

Alternatively the guard can be connected to the BLACK AS-i cable (the auxiliary power cable).

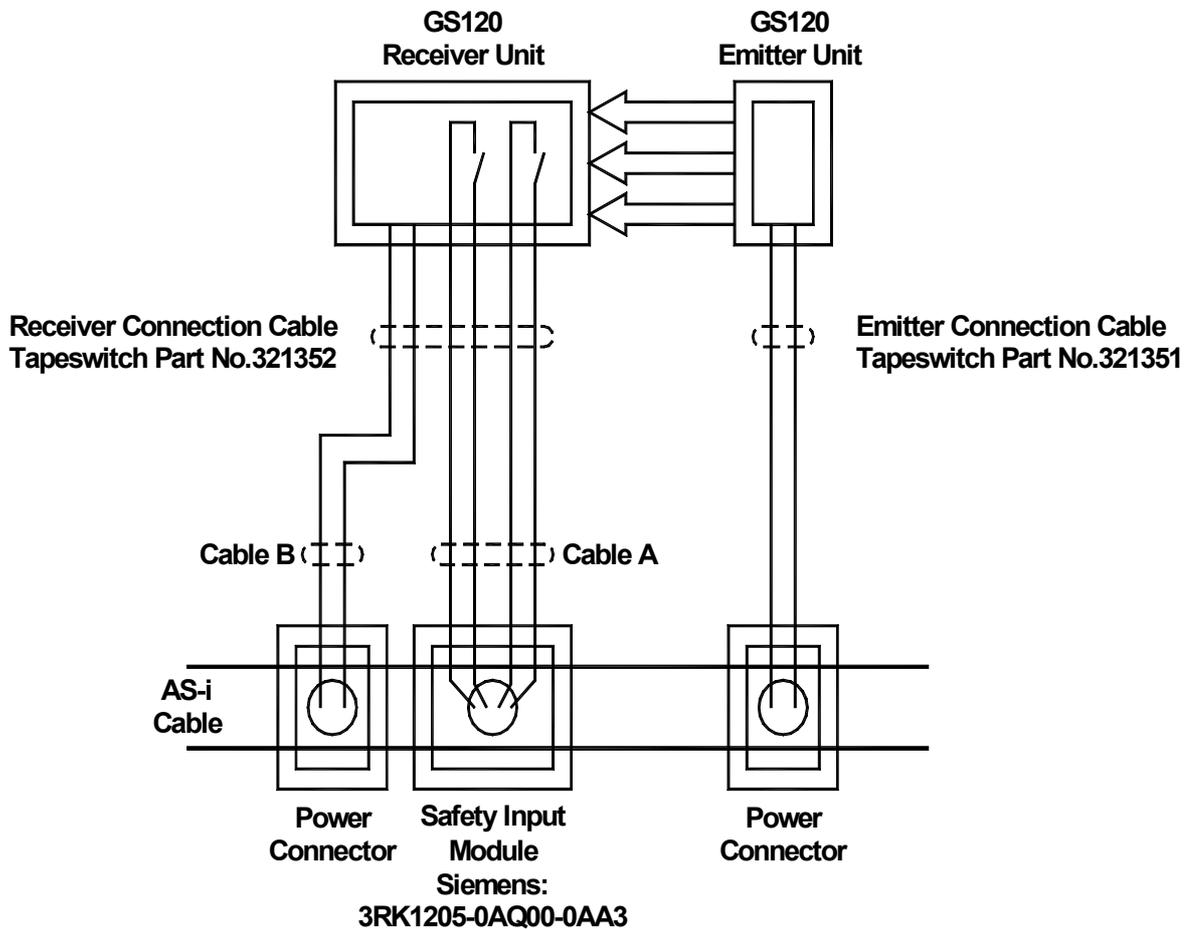


Figure 31

3.4 INITIAL CHECKING AND ALIGNMENT

The procedure for alignment is described below.

Apply power to the GS120 system.

The amber indicators on the emitter and the receiver units should be lit. If either of the indicators are not lit, check the wiring.

The yellow indicators on the emitter and the receiver units should be in the off state. If either of these two indicators are flashing there is a fault, contact your Guardscan distributor. If the yellow indicator on the emitter unit is on constantly, check the wiring as described in section 3.3.2

The green indicator on the receiver unit should be lit, if not, adjust the units into general alignment until the green indicator comes on.

Adjust the units to optimum alignment as follows:

1. Slowly turn the emitter unit clockwise until the green indicator on the receiver unit goes off and the red indicator comes on. Note this position.

2. Then turn the emitter unit anti-clockwise, again until the green indicator goes off and the red indicator comes on. Note this position.

3. Fix the emitter unit at the centre of the two noted positions.

4. Repeat steps 1, 2 and 3 but this time turning the receiver unit.

Using the test piece provided, obstruct the curtain. On the receiver unit the green indicator should go off and the red indicator come on. Move the test piece in and out of the curtain several times and check that the indicators change state appropriately each time.

See section 4.2 of this manual if the system does not function as described above.

The installation of the machine can now be completed. Before putting the machine into use the complete system (i.e. the machine and all its safeguarding devices) should be commissioned by qualified personnel and as a minimum the commissioning checks described in section 4.1.1 of this manual should be performed.

Periodic checks in accordance with section 4.1.2 should be carried out at the prescribed intervals. Daily checks to be performed on the GS120 system are detailed in section 4.1.3 of this manual. In some cases there are specific statutory requirements concerning the examination, inspection and test of a machine and its safety devices. It is for the user to determine if such requirements exist for the machine in question and to ensure that those requirements are met.

4. PERIODIC CHECKING, SERVICING AND MAINTENANCE

4.1 PERIODIC CHECKING

4.1.1 COMMISSIONING CHECKS

The commissioning examination should be carried out by persons who are competent and who possess all the information supplied with the machine and its safety equipment. The results of the examination should be recorded and copies of this record should be kept by the user and the employer of the person performing the examination. The person carrying out the examination should ensure that the following general standard of performance is met:

(a) It should not be possible for the dangerous parts of the machine to be set in motion while the light curtain is penetrated.

(b) Penetration of the light curtain during a dangerous phase of the operation of the machine should result in the dangerous parts being arrested or, where appropriate, assuming an otherwise safe condition, before any part of a person can reach them. It should not be possible for the dangerous parts to be set in motion until the curtain has been cleared, the safety system has been restored to its normal condition and the machine controls have been re-operated.

The person performing the examination should also:

(c) Inspect the position of the light curtain to ensure that it is set at the correct distance from the dangerous parts of the machine as recorded on the machine information label or plate.

(d) Ensure that additional safeguarding measures have been provided where necessary to prevent access to the dangerous parts of the machine not protected by the sensing unit.

(e) Where appropriate, test the overall system response time using a suitable device and ensure that it is the same or less than that recorded on the machine information label or plate.

(f) Test the detection capability of the sensing unit as described in section 4.1.4 of this manual.

(g) Examine the machine controls and connections to the GS120 system to ensure that the requirements described in this manual and in the machine manual have been met.

(h) Examine the stopping performance monitor (if fitted) to ensure that it is fitted and functioning correctly. Ensure that the means whereby the stopping performance can be assessed by the operator is indicating correctly.

(i) Test the muting arrangements (if fitted).

(j) Examine brakes or clutches (if fitted) as recommended.

NOTE: No stopping performance monitor or muting facility is provided with the basic GS120 system and there is no means provided for the connection of such devices to the system. These devices may however have been provided elsewhere in the machine control system.

4.1.2 6 OR 12 MONTHLY CHECKS

These examinations should be carried out by competent persons. The results should be recorded and a copy kept by the user.

The person should ensure that the general standard of performance as described in section 4.1.1 **(a)** and **(b)** is achieved.

The person should perform the commissioning inspections and tests detailed in the section 4.1.1. When checking the stopping performance monitor, item **(e)**, any equally effective means of determining that the overall system response time, as recorded on the machine information label or plate, is not exceeded, is acceptable.

In addition the person should:

(a) Examine all switching elements in the switching paths controlled by the light curtain outputs to ensure that they are functioning correctly and are not in need of maintenance and/or replacement.

(b) Inspect the machine to ensure that there are no mechanical or structural aspects which could prevent the machine from stopping or assuming an otherwise safe condition when called upon to do so.

(c) Examine and inspect the machine controls and the connections to the GS120 system to ensure that no modifications have been made which could adversely affect the system and that suitable modifications have been correctly performed and properly recorded.

4.1.3 DAILY/SETTING EXAMINATION

The following tests should be carried out daily and after setting by a designated person appointed by the machine user. The results should be recorded and a copy should be kept on or near the machine. Specific statutory requirements may apply to certain types of machine. The designated person should:

(a) Check that access to the dangerous parts of the machine is not possible from any direction not protected by the sensing unit and that side and rear guards are in order.

(b) Check that the minimum distance from the dangerous parts of the machinery to the sensing unit is not less than the distance stated on the machine information label or plate.

(c) Check that it is not possible for a person to stand between the dangerous parts of the machine and the sensing unit.

(d) Check that when the muting facility (if fitted) is operative the moving parts are no longer dangerous.

(e) Check that the stopping performance monitor (if fitted) is in use and is set up and functioning correctly.

(f) Check that electrical enclosures are closed and locked and that any keys have been removed for retention by a designated person.

(g) Check for external signs of damage to equipment or to electrical wiring.

(h) Check the detection capability of the GS120 as described in section 4.1.4

4.1.4 CHECKING DETECTION CAPABILITY

The detection capability of the light curtain should be checked as required in the previous sections using the method described below and as shown in Figure 32.

4.1.4.1 GS120 SYSTEM

(a) With power applied to the GS120 system and with the machine at rest, check that the light curtain is functioning by observing the state of the appropriate indicators. The green indicator should be on, the red indicator should be off.

(b) Insert the test piece provided into the curtain with the axis of the test piece perpendicular to the plane of the curtain. Starting at the top of the emitter unit with the test piece less than 150 millimetres from the front of the emitter unit, pass the test piece slowly down the front of the emitter unit. While the full diameter of the test piece is within the area defined by the two arrow markers on the front window, the green indicator should GO OFF AND REMAIN OFF and the red indicator should BE LIT AND REMAIN LIT.

(c) Repeat the above test with the test piece inserted close to the front of the receiver unit and with the test piece inserted at the midpoint between the emitter and receiver units. The indicators should behave as described previously whenever the test piece is between the arrow markers.

WARNING

At no time while the test piece is obstructing the curtain should the green indicator come on. If it does the machine must be isolated and must not be used until the cause has been investigated.

(d) If the system passes the above tests proceed as follows. Initiate a cycle of the machine and then insert the test piece into the curtain. Upon insertion of the test piece during dangerous motion, the dangerous parts should come to rest without apparent delay.

WARNING

If the machine does not stop or there is any delay in its response the machine must be isolated and must not be used until the fault has been rectified.

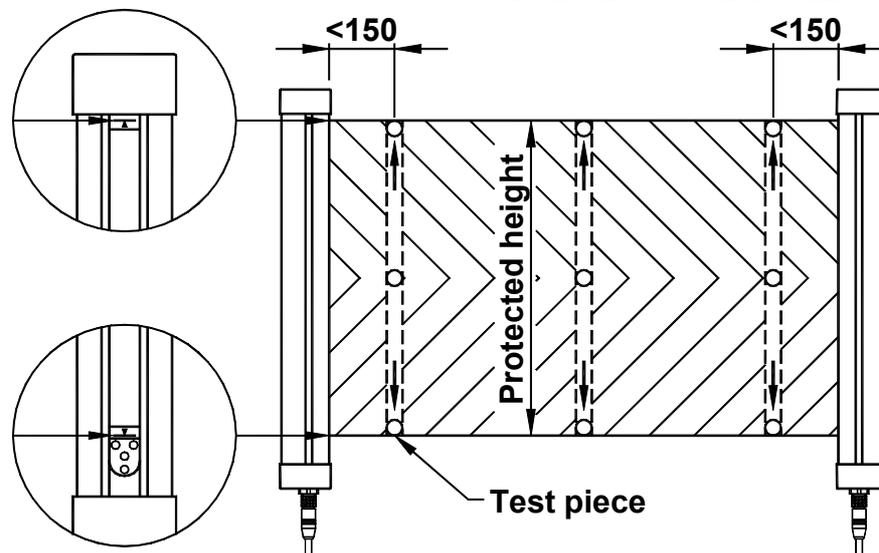


Figure 32

4.1.4.2 GS120 MULTI-BEAM SYSTEM

The operation of the light curtain should be checked as required in the previous sections using the method described below and as shown in Figure 33.

(a) With power applied to the GS120 system and with the machine at rest, check that the light curtain is functioning by observing the state of the appropriate indicators. The green indicator should be on, the red indicator should be off.

(b) To test the curtain is operating correctly, insert your hand in between the emitter and receiver units and obstruct one of the beams, see Figure 33. While the beam is obstructed, the green indicator should GO OFF AND REMAIN OFF and the red indicator should BE LIT AND REMAIN LIT. Move your hand in and out of the beam several times and check that the indicators change state each time as appropriate.

(c) Repeat the above test for each of the beams. The indicators should behave as described above whenever the beams are obstructed.

WARNING

At no time while a beam is obstructed should the green indicator come on. If it does the machine must be isolated and must not be used until the cause has been investigated.

(d) If the system passes the above tests proceed as follows. Initiate a cycle of the machine and then insert your hand into the curtain. Upon insertion of your hand during dangerous motion, the dangerous parts should come to rest without apparent delay.

WARNING

If the machine does not stop or there is any delay in its response the machine must be isolated and must not be used until the fault has been rectified.

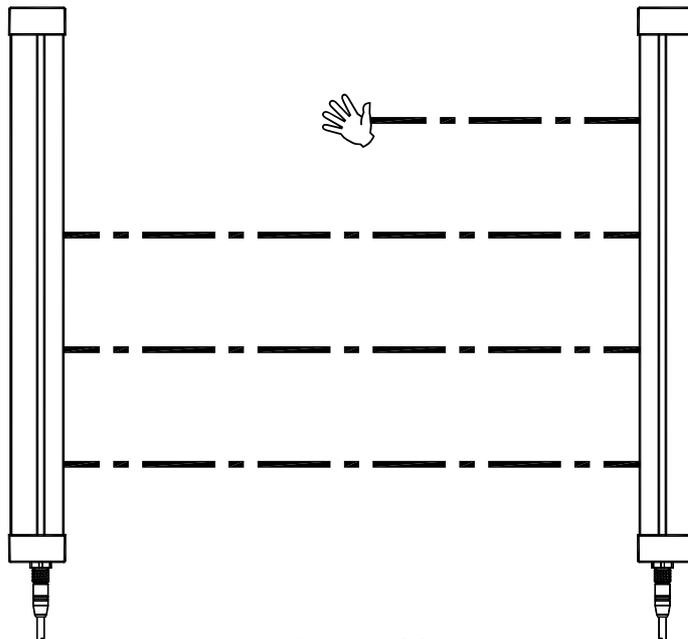


Figure 33

4.2 SERVICING

The GS120 system is designed to be serviced at unit level. There are no user serviceable parts within the units.

When a safety-critical fault occurs in the GS120 system or in the machine interface, the machine will be disabled. It is first necessary to establish whether the fault is in the GS120 system or in the machine interface.

Use **Table 1 / Table 2** to identify faults within the GS120 system.

If you require any assistance with the installation or maintenance of your GS120 light curtain, please contact your Guardscan authorised distributor.

4.3 MAINTENANCE

There are no mechanical, electrical or optical adjustments necessary. Apart from occasionally cleaning the windows of the emitter and receiver units, GS120 systems are maintenance free. Use a soft, lint-free cloth and an anti-static cleaner.

Do not use solvents of any kind.

5. TECHNICAL SPECIFICATION

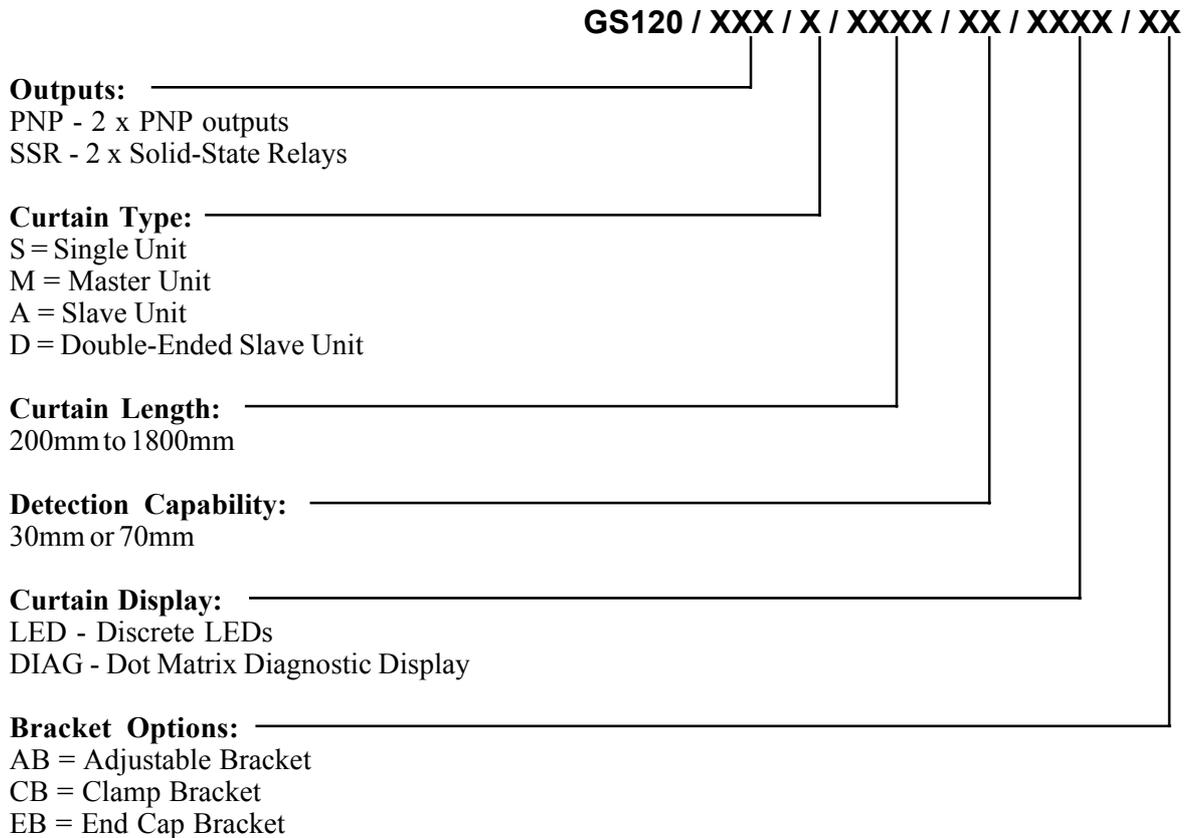
5.1 GS120 LIGHT CURTAIN SYSTEM

Light Curtain & Multi-Beam Systems	S	Single Unit	
	M	Master Unit	
	A	Auxiliary Slave Unit	
	D	Double-Ended Slave Unit	
Light Curtain & Multi-Beam Systems Operating Range	Detection	Range	
	30mm	0.5m to 15m	
	70mm	0.5m to 15m	
	2 beam	0.5m to 30m	
	3 beam	0.5m to 30m	
	4 beam	0.5m to 30m	
Light Curtain Systems Protected Height	30mm	200 to 1800mm	
	70mm	600 to 1800mm	
Multi-Beam Systems Beam Spacing	2 beam	500mm	
	3 beam	400mm	
	4 beam	300mm	
Detection Capability of Light Curtains		30mm or 70mm	
Number of Beams in Multi-Beam Systems		2, 3 or 4	
Effective Aperture Angle		± 5°	
Response Time	30mm detection	20ms upto 600mm curtain. Additional 4ms for each 200mm of curtain.	
	70mm detection	20ms upto 1800mm curtain. Additional 4ms for each 600mm of curtain.	
	Multi-Beam	20ms	
Supply Voltage		24V d.c. ±20%, 5% maximum residual ripple	
Power Consumption		< 12VA	
Enclosure Rating		IP65	
Radiation Wavelength	Wavelength	880nm	
	Intensity	Class 1 LED product (IEC60825-1)	
Safety Output Type	PNP Version	Type	Solid state PNP
		Capacity	0.1A max
		Voltage	Supply voltage minus 2V
	SSR Version	Type	Solid state Volt-free relay
		Capacity	0.1A max
		Voltage	48V (ac or dc) max
	on-resistance	20ohm max	
Standards applied		EN61496 Type 2 & EN954-1 Category 3	
Operating Temperature		0°...50° C	
Storage Temperature		-20°...70° C	
Humidity		15% to 95% non-condensing	
Weight (each unit)		0,3kg plus 0,2kg per 100mm of curtain	
Dimensions - cross section		36 x 45 mm	

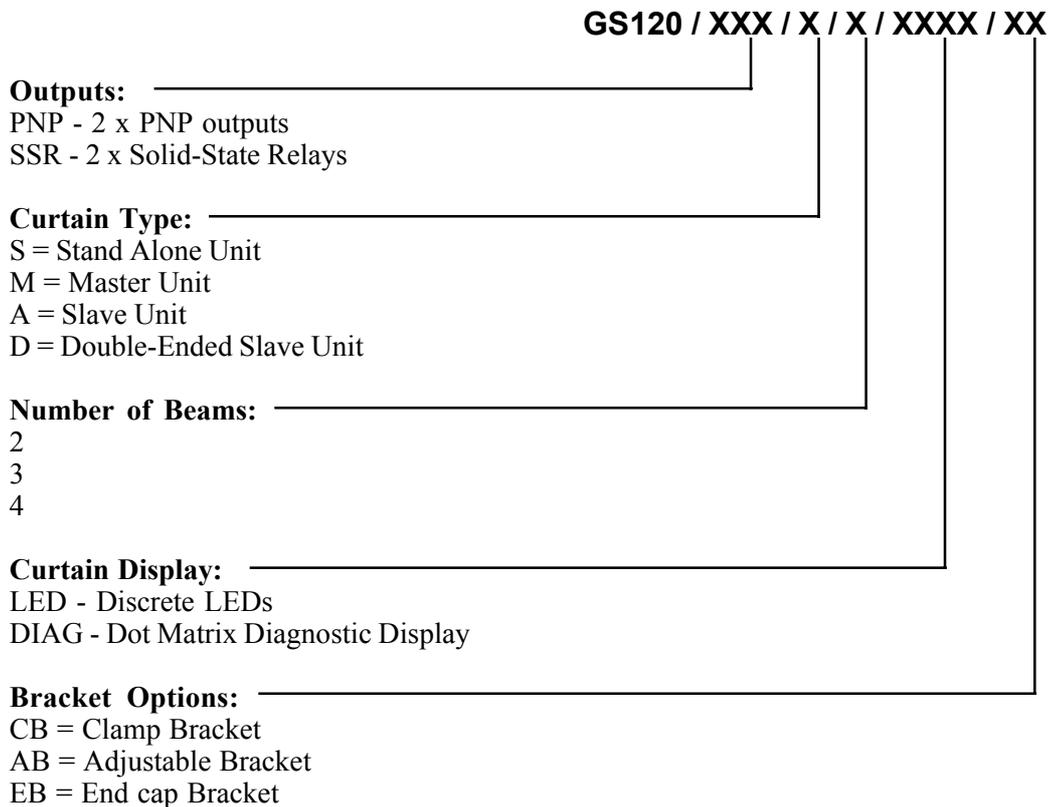
Table 3

5.2 ORDER CODES AND MODEL NUMBERS

5.2.1 GS120 LIGHT CURTAIN ORDER CODE



5.2.2 GS120 MULTI-BEAM ORDER CODE



5.2.3 GS120 CONNECTOR CABLE OPTIONS

GS120 connector cable options are available as listed below:

5.2.3.1 PNP Systems

Emitter cable connector (5 way)	5m
Emitter cable connector (5 way)	10m
Emitter cable connector (5 way)	20m

Receiver cable connector (8 way)	5m
Receiver cable connector (8 way)	10m
Receiver cable connector (8 way)	20m

5.2.3.2 SSR Systems

Receiver & Emitter cable kit	1m
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5.2.3.3 General

Slave connector cable	0.3m
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