Assembly Line Monitoring System

Generally a product made of several Components and Processes is manufactured by adding various Components at different Assembly stations and by running it through several Processes again at different stages. Manufacturing such products necessiates movement of semi finished product from one stage to the next stage which is handled by a conveyor belt kind of a system. At every stage there could be several Components that are added or several Processes that the product is subjected to. In this method of manufacturing at every stage there is a dependency on the previous stages to get a semi finished product, to add some more Components, and to pass it on to the next stage. This method also runs the risk of Assembly line hold up due to any problem in any one of the stages. Thus it is very crucial, to identify stages that are causing hold ups and communicate immediately the exact reason for such hold ups, to the concerned personnel. Speed at which these signals are picked up and communicated actually determines the hold up time of Assembly lines.

The **Assembly Line Monitoring System** designed by Process Care Systems helps in immediately sensing any hold up in any one of the stages automatically and communicates reason for hold up either automatically or with some more inputs from the operator at a particular stage instantaneously.

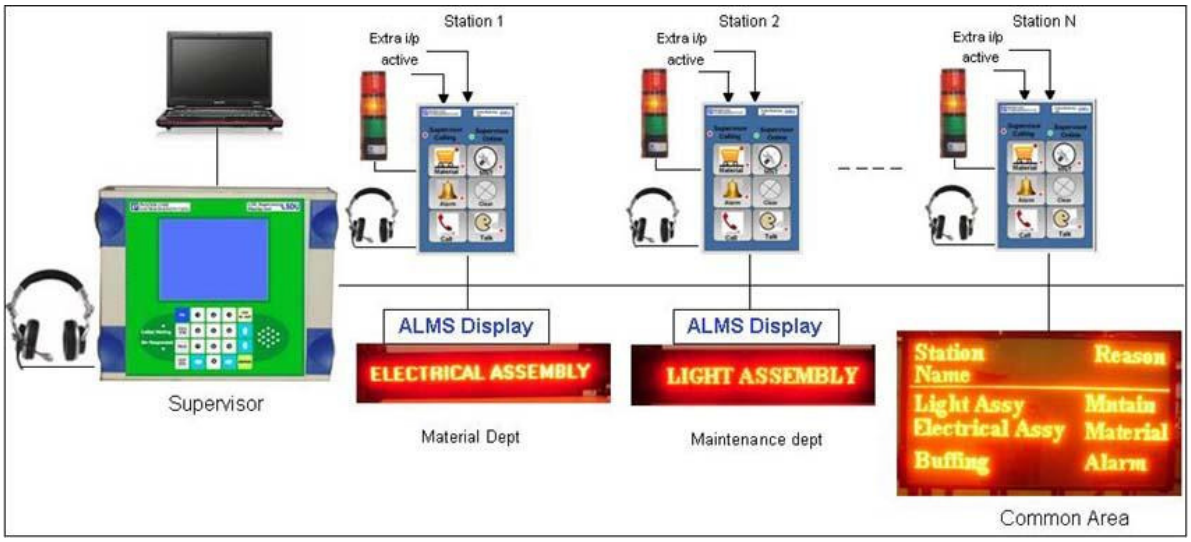
Advantages of our ALMS:

Assembly Line Monitoring System interconnects all the stations in an assembly line to a supervisor. Every assembly station is provided with a Station Monitoring Unit (SMU) which allows the operator at particular station to convey any problem at the station causing the assembly line hold up. Commonly encountered causes are allocated hot keys to immediately convey the cause for holdup by pressing a relevant key. Provision is also made to make a voice call to the supervisor either to communicate a cause or holdup not found on the keypad or to describe already conveyed cause in detail. The addition of this voice channel makes the system user-friendly even for the operators with very little education and only knowing the regional language.

Product Features:

- Station Monitoring Unit can send if a station is down automatically by continuously monitoring activity at the Station.
- Programmable threshold time after which a station is declared to be down in the absence of activity.
- Both audio visual alarms are activated when a station is down attracting the operator to communicate the reason for down by pressing a relevant key.
- Option is available to pickup extra four ON/OFF inputs from a process or machine.
- Voice channel is provided to describe problem associated with a station to enable communication in a regional language.
- LED based Jumbo displays can be integrated to publish problems at different stations.
- Usage of LCD Supervisory display unit makes the system work in a stand alone mode without any help of a PC.
- Provision is made to segregate the reasons for down at several stations and route them to the respective departments to be showed on an LED display board.

Functional block diagram



In Assembly Line Monitoring System each machine/station will have an electronic device called Station Monitoring Unit (SMU) installed with a Tower Lamp (optional) connected to it. Three lamps with colors Red, Amber, Green in the Tower lamp are used to indicate different status of that particular machine /station. Machine running normally is indicated by lighting up of green lamp and down is indicated by continuous flashing of red lamp. When operator acknowledges this down by pressing one of the keys: Material, Maintenance, or Alarm, amber lamp will light up with all remaining lamps turned off. All these Station Monitoring units are connected to an LSDU [LCD Supervisory Display Unit, a master unit controlling all assembly's] through RS-485 bus. As many as 16 assembly stations can be monitored by one LSDU unit. If the machine is down due to some specific reason and is not started within threshold time Red Lamp starts flashing along with buzzer until it gets proper reason from key input of SMU.

Station Monitoring Unit

Station Monitoring Unit (SMU) is simple in construction with a keypad having six keys. The LED 'Supervisor Calling' will light up when supervisor calls particular operator. 'Supervisor Online' LED indicates supervisor is already in conversation with other operator or has responded to the call. SMU will also have a jack at the rear end to which headphone can be connected.

Six keys on the 'SMU' are meant for different functions. They are as follows:

1. **'Material'** key:

This key is used by the operator at the station to inform the shortage of material to the supervisor. This key operation will light up an image on the LSDU corresponding to material. Appropriate text and image is displayed on LSDU with a beep sound to attract the attention of the supervisor.

2. **'MNT'** key (Maintenance key):

This key is used by the operator at the station to request for repair and maintenance.

3. **'ALARM'** key:

This key is used to raise an alarm in case of emergency.

4. **'Clear'** Key:

This key is used to clear the alarm.

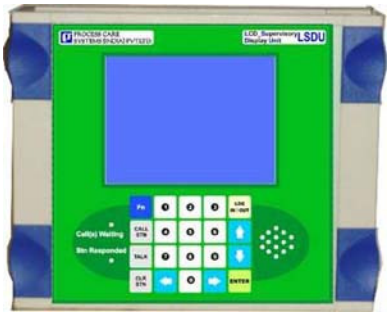
5. **'CALL'** key:

This key is used to make a call to the supervisor. This will light up 'Call(s) Waiting' LED at the LSDU along with beep sound. Supervisor acknowledges the call by pressing 'Talk' on LSDU. Operator can brief him about the shortage of material or breakdown of machine etc. SMU will have a jack at the rear end to which headphone can be connected.

6. **'Talk'** key:

This key on SMU is used by operator to get connected to the supervisor in case he is calling (i.e., when 'Supervisor Calling' LED is turned on).

LCD SUPERVISORY DISPLAY



- Designed to get the Maintenance and Material requests from the Assembly stations and to flash corresponding symbols on display module.
- - enables Supervisor to call an operator of any Station by pressing 'CALL STN' key.

This module consists of

- 1.1 320x240 pixel LCD Display module:
- 1.2 20 keys Membrane Key pad.
- 1.3 Call(s) Waiting' LED to indicate whether Operator(s) is/are waiting to talk to supervisor, 'Stn Responded' to indicate whether operator responded to supervisor's call or not.

1. '**LOG IN/OUT**' key:

This key is used to LOG IN to the LCD Supervisory Display Unit. Usually the unit will be in standby mode and the LCD display is off. The unit enters in to this mode whenever a Supervisor Logs out. Just before the start of production, Supervisor has to press the 'LOG IN/OUT' key for about 2 seconds if the unit is in standby mode. Then the LCD display Unit will come ON and initially show all the connected Station Names.

Same key is used for Log Off also. When LCD Display Unit is on, pressing 'LOG IN/OUT' key and holding it for 2 seconds time will turn off LCD display Unit and LSDU stops working.

2. **'Fn'** key (Station List): Pressing this key will perform a list of functions.

a) Set Date and Time
b) STN LST - enlist all the SMUs with Station Names. A max. of 63 stations can be connected to one LCD Supervisory Display Unit [LSDU].

3. '**CALL STN**' key (Call Station): On pressing this key, LCD will show a list of all the station names. Supervisor can move the cursor to the appropriate station and press 'ENTER'. Now 'Supervisor Calling' LED on the SMU of corresponding station starts blinking with a beep. Operator at that station can talk to Supervisor by pressing 'Talk' key. This action of operator will turn on 'Stn Responded' LED on LSDU.

4. '**TALK**' key (Call Station): When 'Call(s) Waiting' LED starts blinking with intermittent beep, it is evident that one or more operators at stations are calling. Supervisor has to press Talk key in order to converse with operator(s). LSDU will display a list of operators waiting to talk. A particular Station can be chosen either by moving the cursor using UP/DOWN key or by entering the serial no. of the station directly followed by pressing of 'ENTER' key.

5. '**CLR STN**' Key: After serving the station for its request, flashing image with station name on LCD can be cleared by pressing this key. This will load list of stations who are waiting for material or maintenance. From this list desired station can be removed.

6. '**MUTE**' Key: This key is used to mute the beep sound generated when operator at an Assembly station presses material, maintenance or 'Call' key on the SMU.

7. **'←' and '→'** keys:

These keys are used to move the cursor position in horizontal direction.

8. ' ↑ ' and '↓' keys:

These keys are used to scroll through list of entries like Station names

9. '**ENTER**' key:

This key is used to select the chosen entry in the list, to call an operator or clear a call etc.

As shown in the block diagram of ALMS, all relevant departments will have a display where station names of those raising requests will be displayed one after the other at a relevant department.

A big 144 x 80 pixels common display can be placed at the prominent place in the assembly line to display station names of the machines which are down. If the machines are more than 10, all machines are covered by flipping the machine names. Several such LSDUs can be connected to the centralized PC using RS 485 bus. PC will record all these information from different stations and stores it with date time stamp which is used to generate various MIS reports.