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NEWSLETTER FOR MANUFACTURING COMMUNITY

WORD FOR THE DAY: **COMPUTER TERMINOLOGIES**

When Blasé Pascal and many other scientists made a “computer” to perform basic addition and subtractions some fifty years back, the electronic components consisting of power supplies, valves, cooling fans occupied one big room !! And, it took quite a long time to perform simple calculations. And, there were many cooling fans running to keep the electronic components from burning themselves. How far we all have come today. Sitting somewhere on a beach side or from the comfort of bedroom, you can browse the internet and keep a check on what is happening anywhere in the world, within minutes. This technological revolution is not only limited to satisfy our “audio-visual” (entertainment) needs. It has changed the way in which even machines function and communicate. It is simply amazing just to know that a bunch of satellites, millions of kilometers of optic fiber cables, telephone cables, wireless towers, many computers transcend all national borders and lets to talk to your loved ones anywhere on this beautiful globe (if you have someone in Moon or Mars, you can still communicate !!!)

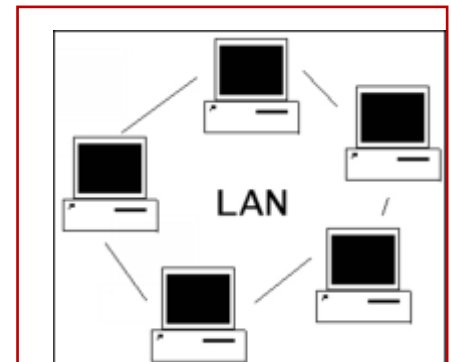
With so much of technological changes happening around us, independent of where and which department we work in, it is imperative to know a little about them which will help us understand, communicate and work better in this “electronic era.” This week, let us just brush upon some of the “technical jargons” commonly used in day to day affairs. This newsletter does not intend to elaborate in detail since each will be a subject by itself. Welcome aboard for a electronic journey !!

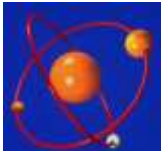
USB – Universal Series Bus – A common “port” available on modern computers, programmable logic controllers and many electronic devices. As the name implies, it is “universal” in connectivity. An external memory drive (pen drive), printer, or any device with USB cable can be connected. The system will be programmed to automatically detect hardware type and perform corresponding action. It has a high data transfer rate of up to 12 MBps. It communicates in serial mode using four pins.

- Example
- i) Flash memory card
 - ii) Printers
 - iii) Advanced variable speed drives for downloading parameters
 - iv) Latest PLC machines for downloading machine programs



LAN – Local Area Network – A network of computers, peripheral devices like scanners, printers, projectors. The LAN system can be broadly divided into two sections: “CLIENT” & “SERVER.” Client is a computer (sometimes also called terminal) that requests some information or a task to be accomplished. For example, a client can request for printing a document or can download some file. The “server” checks all requests by all clients and assigns priority to their requests. The task of assigning priorities, creating different client groups and access controls is broadly called as “Network Administration.” A LAN system consists of computers, routers, servers, various network cables. Each computer will be





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identified on LAN system by a unique code called IP (Internet Protocol) address.

When the network of computer increases, it is called as WAN or Wide Area Network. INTERNET (INTERNational NETWORK) is a huge network of thousands of LAN and WAN. When a network is used within an organization with limited access to a specific group of people, it is called INTRANET.

Example

- i) Office networks
- ii) Internet café
- iii) Machine control systems

JPEG / PNG / WMF / TIFF / GIF / BMP / DWG / DXF - With the advent of digital cameras and scanners, capturing, storing, editing and sharing images became more simple and easier. E-mailing images as attachments or uploading to public network is an extremely simple task. Let us take a look at some commonly used image storing formats.

JPEG –Joint Photographic Experts Group – One of the most widely used formats of storing images. The image stored will have JPEG or JPG as file extensions. This image format needs less memory space and hence can be easily sent as attachments. One disadvantage of this file format is its lack of sharpness. An extremely rich colorful picture will lose clarity when viewing. This will be specially obvious when you try to zoom the image more than its original size. Will be very useful for storing scanning drawings, manuals and overview pictures.

Examples:

- i) Machine Manuals
- ii) Work Instructions / Work Station photos
- iii) Prints / Overall pictures

PNG – Portable Network Graphics – This format is extremely useful when storing pictures for more clarity. Although this format requires more memory space than JPG format, it retains all the finer details of image. If picture of some critical component needs to be exchanged for communication, use this format. The image can be zoomed without losing clarity.

Examples:

- i) Broken or damaged parts of machine
- ii) Electronic PCBs / Small components
- iii) Extremely colorful pictures

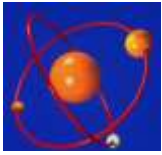
WMF – Windows Meta File – A format specifically created by Microsoft for their windows applications. This format is widely used for storing line diagrams, flow charts. The images having less colors but more size can be stored in this format. This image format also requires less disk space.

Examples:

- i) Line Diagrams
- ii) Flow Charts
- iii) Component Diagrams

TIFF - Tagged Image File Format

GIF – Graphic Interchange Format



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GIF and TIFF formats are also enhanced versions of image storing. They are used more in creation of animated files which are widely used on web pages.

BMP – Bit Map is another image format with high quality. For common tasks, it is not advisable to use these formats since they require large memory space. They are used in creation of internet pages and color specific applications. MS Paintbrush is one of the most common applications used for creating bit map images.

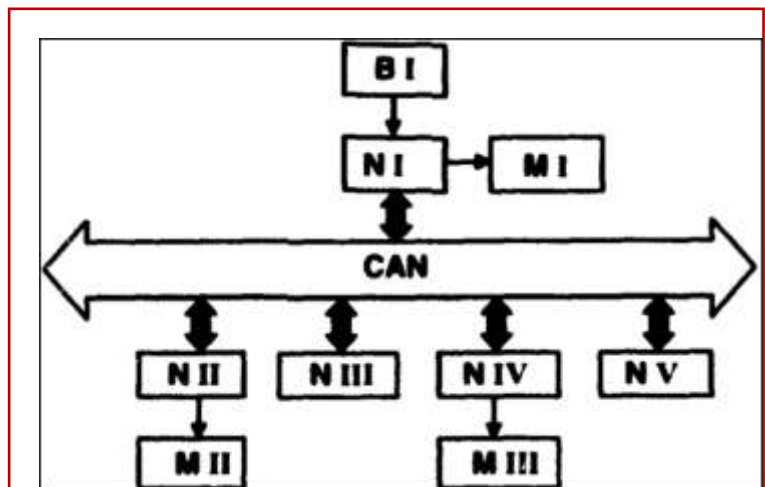
DWG / DXF – Drawing or Drawing Exchange Format are the two most common methods of storing drawing files which are created using different drafting tools like AutoCAD and Solid Works. These drawing will be made to scale and illustrate actual dimensions of an object being drawn.

MP3 / MP4 / WMV - With everything becoming digital, audio is definitely not left behind. Audio need not necessarily mean only music or a song. The sound recording s of machine, generating set or observations of shock pulse monitoring are also considered as sound. MP3 and MP4 are the most common methods of storing music files in “compressed” form. MP3 is a short form for MPEG – 3 which when abbreviated means Motion Picture Experts Group – Layer 3. It is a type of compression technology used to reduce the size of sound file by almost 60%. Although MP4 stores the file with lesser memory requirement, it loses the clarity of original sound track. For most practical purposes, MP3 will satisfy the need.

Examples:

- i) Music / Song files
- ii) Voice recording of doctors, experts talking on subject
- iii) Any audio conversation

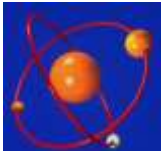
CAN BUS – Controller Area Network – It is an industry standard and comes under the distributed control system category. It is a serial network type where more than one CAN-product (PLC or a Drive or a PC) are connected in series. Each CAN product is called a node and communicate with each other according to the priority. In CAN bus, all controllers will not be able to communicate simultaneously. After one CAN product completes the task, other CAN product will take over. This method of communication is called “token passing” and is used widely in latest industrial control systems. CAN bus was originally set-up and used by Robert Bosch for their automotive applications, but gained popularity later in all other industry segments.



Examples

- i) Engine Control Units
- ii) Medium machine control systems
- iii) PLC Controlled machines
- iv) Special purpose machines

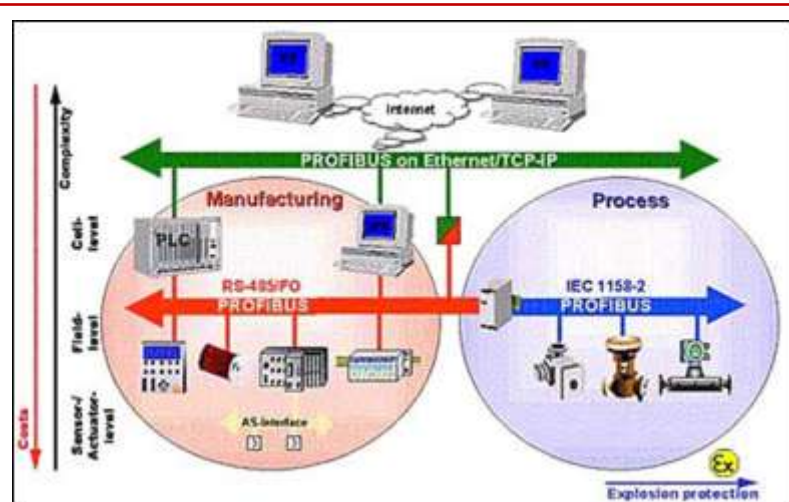
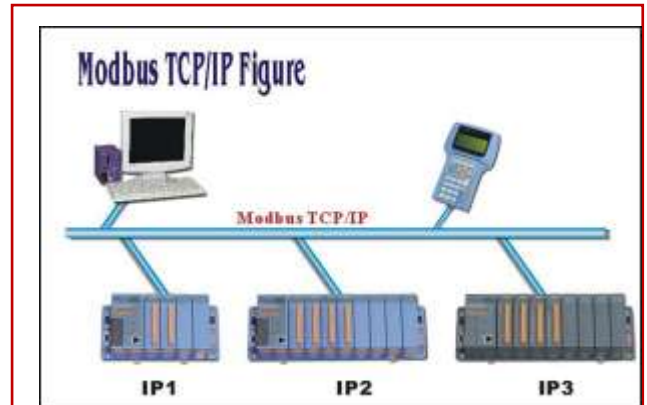
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MODBUS – This is an RS-485 based peer-to-peer network protocol which uses the MODBUS data structure. It transmits at 1 Mbps and allows up to 32 nodes on a network. Most of industrial control system manufacturers when designing a total DCS use MODBUS as common standard. For example, a combination of many PLCs, drives, data acquisition system can be connected using a common MODBUS network. With the addition of “repeater”, up to 64 nodes can be connected without compromising on the data transfer speed. The end nodes which are not further connected to any other subsequent nodes must be terminated with a resistor – usually 120 OHMS – to avoid noise created by open wires.



PROFIBUS : Process Field Bus is a standard for field bus communication in automation technology. It is somewhat similar to MODBUS architecture. Individual components like valves, sensors can also be PROFIBUS enabled and can be connected to the network.

RS-232C – One of most common Recommended Standards developed by Electronic Industries Association (EIA). It communicates in serial mode. Originally RS232C was designed to use DB25 (25 pin) connector but gradually changed to 9-pin DB9

connector. RS232C is an unbalanced system and hence cannot communicate over very long distance, usually not more than 15 meters (45 meters) at a baud rate of 19.5 Kbps. The most common six pins used on RS232C are listed below:

Protective Ground – Should be connected to an outer shield conductor and tied to the chassis on ONE END ONLY.

TD – Serial “Transmit Data,” an output

RD – Serial “Receive Data,” an input

RTS – Request To Send, an output

CTS – Clear To Send, an input

DSR – Data Set Ready, an input

DTR – Data Terminal Ready, an output

(DSR & DTR indicate that the equipment is powered and ready to communicate)

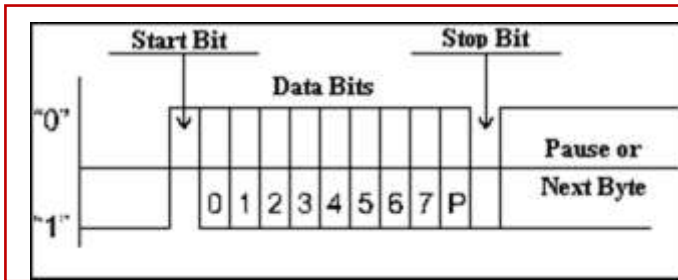
Signal Ground – Common signal reference. Should not be connected to any external ground



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The standard circuitry uses voltage level between +3 to +25 V DC to represent “one” and between -3 to -25V to represent “zero” binary conditions. The information is passed in a packet of 8 bits at a time.



RS-422 – This communication standard is a more balanced system compared to RS232C and hence can communicate over long distances, at much faster baud rate. Two separate set of wires are used for “receiving” and “transmitting” data (compared to RS232 where only one common wire is referenced for both receiving and transmission). This cable standard can transmit data at almost 10Mbps up to 1200 meters (4000 feet). RS-422 is the most commonly used method of communication between PLCs, auxiliary equipments like drives, control board.



The latest energy monitoring devices are also available with RS422 interface. When downloading data to a central computer, usually a “RS-422 to RS-232C” or “RS-422 to USB” converters are used.

RS-485 – This communication standard is similar to RS422 EXCEPT that a device which is NOT communicating can also be connected without interfering with other ACTIVE devices. One of the best example of RS-485 network is DCS system of many programmable logic controllers. If for any reason, one PLC is disabled, it need not be disconnected from the network (The device which is NOT communicating on line goes to HIGH IMPEDANCE state in a RS-485 network). RS-485 allows transmission up to 100 Kbps for a distance of 1200 meters (4000 feet).

CLIENT / SERVER – One of the most common terminology used in a networking system. The multiple computers present on a network are broadly divided into two groups based on their functionality. Those which “request” for any information is called a CLIENT. They may not necessarily store the information with them. Those computers which “serve” and complete any request from client is called a SERVER. For example, you log-in to your bank account to check the balance. The computer from which you log-in is a CLIENT request balance information. The computer which belongs to the bank having your account balance information becomes a SERVER providing necessary information when requested.

SWF – Shock Wave File – It is also called a FLASH file and stores animated files. The animated files will be created using various latest applications like Adobe and are widely used in creating training modules. To view SWF file formats, you should install Adobe Flash Player® or Adobe Shock Wave Player® (or equivalent) on your computer. It is one of the most interactive methods of creating multimedia applications.

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RJ11 – The cable connecting telephone line or MODEM (Modulation-DEModulation) to the computer. It is a single pair cable performing serial communication with the service provider. It is also the common cable connected to telephones.

PROTOCOL – Every activity needs certain guide lines. There will be certain rules and regulations that every object must follow in different circumstances. Any such commonly agreed and established method of standardized procedure is called PROTOCOL and will be equally applicable in electronic field also. All communications methods like LAN, WAN, RS232, RS485 are called protocols. The hardware including cables, connectors and necessary software follow certain set of protocols all over the world for easier exchange of information and interchangeability.

BAUD RATE – The most widely used method of indicating data transfer speed in a communication line. The baud rate is usually displayed in Kbps or Mbps which stands for KILO BITS (not BYTES) or MEGA BITS (not BYTES) per second. Based on the connection and traffic at any given point of time, the baud rate will vary and is not fixed.

LPT – Line Parallel Terminal – This is a communication method, usually used on printers and photo copying machines. As the name says, the communication is parallel and hence data transfer will be faster compared to a serial communication. LPT type of connections are also widely used in expansion modules of a PLC system. They are also used in connecting output from analog modules to individual field boards.

COMBO DRIVE – As the name suggest it is a COMBINATION drive which can read and write almost all types of CDs – Data, Music, Video, VCD, DVD and Blue Ray discs. It can also write (called “burning”) to various types of CDs at different speeds. It is available in different types to suit desktop PCs, laptops. It is also available as a separate system which can be connected externally thru USB port. One of the important parameter for a CD drive is its speed. We all have heard of 8X, 24X or 48X speed drives. The “X” stands for data transfer rate and one X is equal to 150 KILO BYTES PER SECOND (KBps). The speed at which reading or recording is done is dependent on type of combo drive and information on the CD. There are non-combo drives available which either can read only CDs, DVDs or VCDs but are fast becoming obsolete with affordability of combo drives.

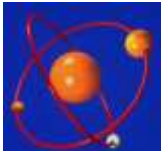


What is SERIAL & PARALLEL communication?

As the name implies, any exchange of information happening on same physical wire is called serial communication. It is similar to one single road in which vehicles from both side travel. To reduce the time, the vehicles must travel very fast.

When “receiving” and “transmitting” happens on two DIFFERENT physical wires, the communication becomes parallel. It is similar to having two separate roads for vehicles travelling in two directions. Independent of road and vehicle condition, there will be no OBSTRUCTION (technically called COLLISION) between two signals.

But with advancement in “vehicle speed” serial communication is becoming popular since it requires only one pair of cable. USB is the best example of high speed serial communication which transmits at almost 12 Mbps. LPT is the best example of high speed parallel communication which can transmit at 10 to 15 Mbps.

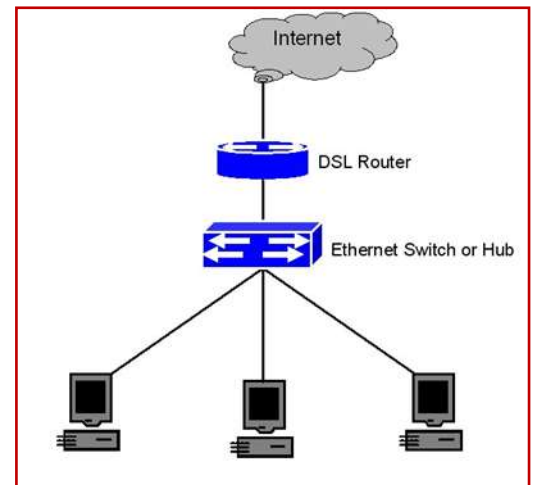


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FLASH CARD - There are many technologies of storing digital information. It can be stored on floppy disks (which has become outdated), hard disk drives, cassettes, CDs. The latest technology using “nano electronics” is flash memory. A flash memory card can be tremendously small in size holding large volumes of data. Pen drives, SD cards commonly used on digital cameras, external hard disks are the example of flash technology based storage devices. Although they are extremely compact, their storage in ideal conditions is essential for prolonged life. They are not as rugged as a compact disc or hard-disk drive.

ETHERNET – One of the most common methods of connecting network computers. It was originally configured by Xerox Corporation (makers of photo copying machines) to connect their large computer network. It gradually became a world standard and started being used in typical LAN type of network systems. The Ethernet communication is accomplished using either a flat 8 pin cable or co-axial cable or optic fiber cable. The need for specific type of cable depends on distance, reliability of information and speed at which data has to be transmitted. Of course, it is possible to have a mix of all these types in one ETHERNET network. CAT-5 and CAT-6 type flat cables are the most commonly used methods found in typical factory. Lot of machine control systems also have adopted Ethernet as the standard communication protocol. There are two advantages of using Ethernet on machine control system. One, it will allow faster data transmission between machines located very far in a factory. Second, it can be accessed from internet anywhere in the world. For example, if machine manufacturer wants to look into any program details, they can log-in from anywhere to this machine and go thru every detail. It is even possible to operate entire machine system from remote connection. That is the power of Ethernet enabled machines !!



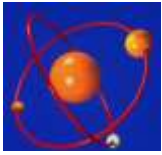
Following table gives a brief description of different communication standards used in Ethernet

(The most commonly used Ethernet cable is highlighted yellow. Twisted pair CAT cable is also called RJ-45 type)

Signal Name	AKA	Data Rate	Maximum Distance	Special Designation	Media
10Base2	Thinnet	10 Mbps	185 meters (616 feet)	Approximately 200 meters	50 OHM thin co-axial cable
10Base5	Thicknet	10 Mbps	500 meters (1665 feet)	Approximately 500 meters	50 OHM thick co-axial cable
10BaseT		10 Mbps	100 meters (330 feet)	Twisted pair cable	CAT 3 or 4 twisted pair cable
10BaseF		10 Mbps	2000 meters (6600 feet)	Fiber optic cable	
100BaseT	Fast Ethernet	100 Mbps	100 meters (330 feet)	Twisted pair cable	CAT 5 twisted pair cable
100BaseF	Fast Ethernet	100 Mbps	400 meters (1332 feet)	Fiber optic cable	

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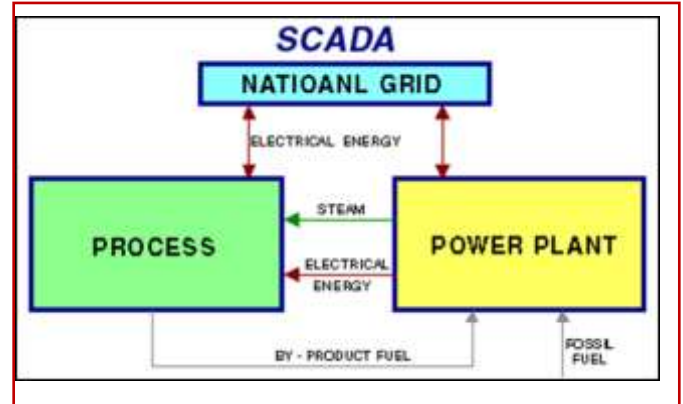


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1000BaseT	Gigabit Ethernet	1000 Mbps	100 meters (330 feet)	Twisted pair cable	CAT 5e or 6 twisted pair cable
1000BaseF	Gigabit Ethernet	1000 Mbps	220 meters (732.6 feet)	Fiber optic cable	

DCS - Distributed Control System is a method of connecting many machines which will have its own control system utilizing any of the protocols discussed above. CANBUS, PROFIBUS, MODBUS are some of the common methods of networking multiple controllers in a DCS. Each machine will have its own controller and program. They will be able to run independently but will be interconnected for exchanging various inputs, outputs and common commands. Packaging machineries, paper mills, chemical industries will have DCS for their machines.



SCADA – Supervisory Control And Data Acquisition is a centralized system of having an “overview” of entire process set-up. All machines can be controlled from a central point and real-time data can be obtained about the process and machine status. Large refineries, power stations, power transmission and distribution, air traffic control, railway signal control are some of the examples of vastness of SCADA.

What is Wi-Fi Zone?

Basically, a network in which a computer can communicate with others WITHOUT a physical cable but using radio frequency is a Wi (WIRELESS) – Fi (FIDELITY) zone. Normally, Wi-Fi zones are found in airports, hotels, big shopping malls and some offices. Wireless-LAN is another terminology used for identifying Wi-Fi zone.

Example: USB WIRELESS MODEM USED ON LAPTOPS
LAN NETWORK CARD
INTERNET BROWSING FROM MOBILE PHONES

What is MODEM ?

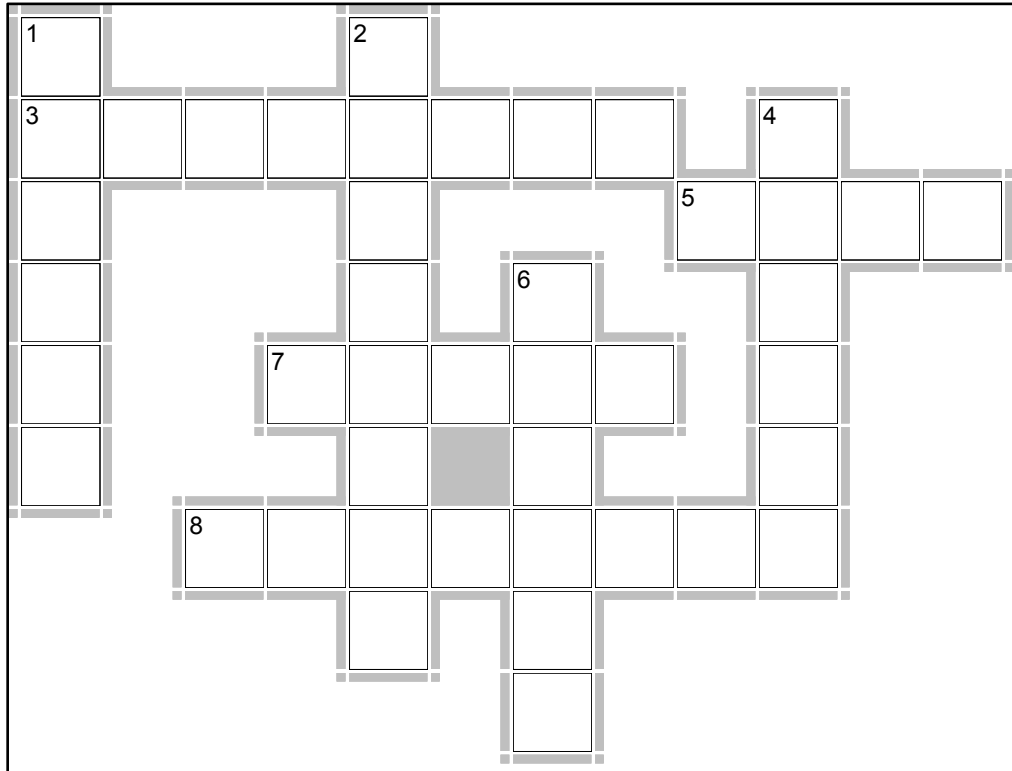
MODEM is a device which converts DIGITAL signal from computers to ANALOG signals to be transmitted on telephone line and vice-versa. MODEM means MODulation (convert from digital to analog) – DEModulation (convert from analog digital). It is the most important and vital equipment for communication using telephone lines. The next stage of MODEM is development of BROADBAND which uses same telephone line, but communicates at much higher speed.



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Now, don't you think we should all let our brains DIGITIZE itself a little bit and solve the Techuzzle on whatever we were reading till now?



Across

3. A common LAN system in the world
5. The rate of data transfer
7. Vital device for communicating on telephone line
8. Process Field Bus?

Down

1. Who will satisfy the client?
2. A strict communication standard
4. This bus can connect many machines
6. Communication method of SINGLE ROAD