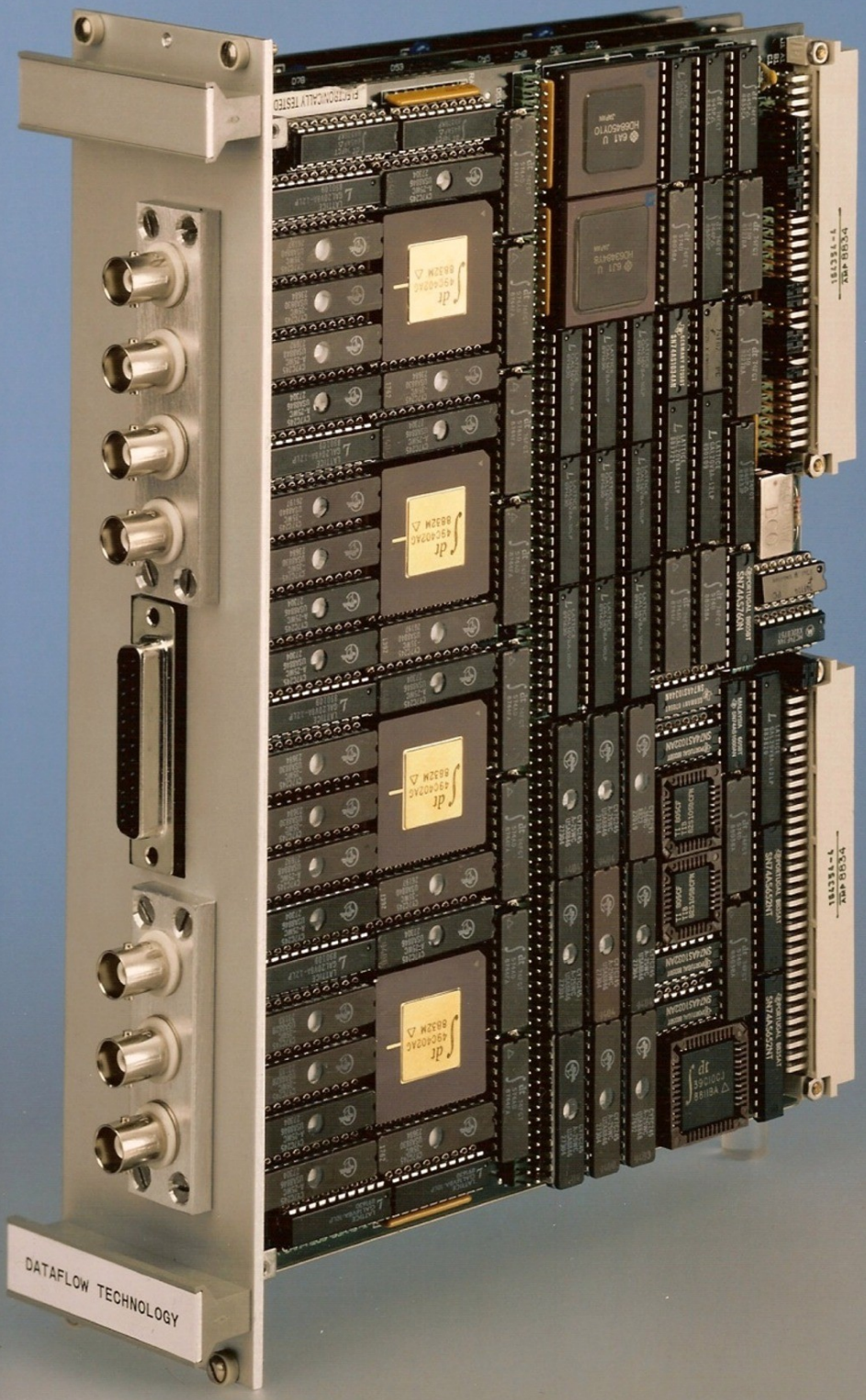
Graphics and Image processing
Systollic Array and Video I/O board (1990)



Dataflow Technology Nederland

1. PRODUCT DESCRIPTION

EVERYTHING YOU NEED IN ONE UNIT !.
The DTN graphics board is a state of the art ultra high performance graphics board with an extreemly powerfull on board **128 MIPS** Systolic Array for bitblt, (3D-)graphics and image processing functions. It has a programmable video output for almost all video standards worldwide and the board includes a frame grabber also for all video formats.

It incorporates a complete solution for graphics in a way unfound in the market place today. All the way from loading pictures from an arbitrary video source, processing them and/or using them in graphical representations.

SYSTEM INTEGRATION AVOIDS BOTTLENECKS.
Applications with graphics need a range of different processing steps each of which can be very time consuming without the appropiate hardware support, or inadequate integration of the different system components, (e.q: the lack of speed of standard system busses). One part off the chain without the adequate speed can slow down the application as a whole. The DTN graphics board however has everthing integrated into one unit.

PAL, NTSC, SECAM, SUN COLOR, HI-RES(1280x1024), VGA COMPATIBLE.
And more, The programmable video hardware allows you to adapt to almost any video standard worldwide. Video output upto 125 MHz dot clocks, and real time input (frame grabber) upto 32 MHz dot clocks.

VME BUS COMPATIBLE.
The board is compatible with the VME bus industry standard. It can be integrated within any VME bus environment.

C LANGUAGE COMPATIBLE.
The C software interface provides an easy way to harnass the power of the on board hardware. A variety of functions are reachable in a simple and straight forward manner from your programs written in the C language.

SUN GRAPHICS COMPATIBLE.
Graphics compatibility is archieved by implementing the SUN's low level graphics software directly into the Systollic Array hardware. This means direct compatibility for all graphics software like SunView/SunTools, SunGKS, SunCGI, SunCore, SunPhigs, NeWS, X-windows etc.

ULTRA HIGH PERFORMANCE.
The 128 MIPS systolic array provides you with a combination of functionality and ultra high speed unequaled by any other graphics board. Just have a peek at the performance figures provided in the chapter on the Systollic Array!

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APPLICATIONS WITH DATAFLOW TECHNOLOGY'S GRAPHICS BOARD:

Multi functionality uses resources very efficiently and integrates the parts of your application. Flexible programmable hardware allows interfaces to almost any standard and allows world wide marketing. Highly advanced technology ensures leadership in the market place for years. Some examples:

INTEGRATE TV ANIMATION AND WORKSTATION ENVIRONMENTS.

- The powerfull low level graphics functions provide an easy way to write ultra fast software in C that maps tv motion picures on things like rotating cubes, waving flags, turning cilinders, curling bands or whatever you can think of.

COMBINE AUTOMATED MANUFACTURING WITH WORKSTATIONS.

- Use a TV camera for (color) picture input.
- Perform real time edge detection, filtering, correlation, histograms etc.
- Affine transformation rotates, scales, shifts objects for alignment.
- See what is happening in windows on your monitor.
- Use the workstations network for complete factory control.

COMBINE DESK TOP PUBLISHING WITH BROADCAST TV CAMERA INPUT.

- Use a TV camera for (color) picture input.
- Use the graphics functions to scale, rotate, move the pictures in real time.
- Use the image processing functions to improve the quality of the picture.
- Use the image processing functions for special effects.

COMBINE DATABASES WITH COLOR PICTURES.

- A stock with thousands of complex articles?
- Undecipherable descriptions?
- New employees need years to get to know them?
- Combine a workstation with a picture database!

- Hundreds of people working in a building?
- Who is working there and who not?
- Combine a workstation with a picture database!

COMBINE IMAGE PROCESSING WITH 3D GRAPHICS.

- Modern medical equipment reveals the inside of a patients body
- The presentation however is sometimes far from optimal.
- Converting slices of planar information into a realistic three dimensional picure requires both image processing and 3D surface rendering.
- The DTN graphics board provides the speed you need.

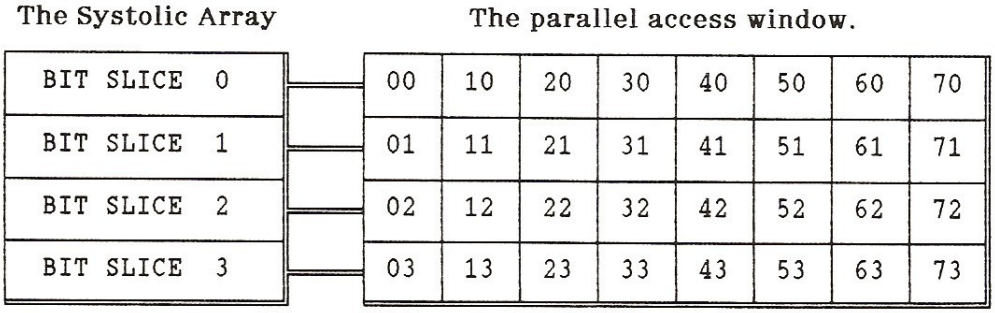
2. THE SYSTOLIC ARRAY.

The Systolic Array is implemented with four very high speed 16 bit CMOS Bit Slices and eight very high speed function EPROMs giving practical achievable burst rates of 128 million instructions per second.

A large number of useful functions are preprogrammed into the boards high speed EPROMs. These include bitblt, image processing and graphic functions. A list of performance figures is given on the following pages.

THE ARCHITECTURE

The Systolic Array can access any 4 by 8 pixel window in parallel and perform read or write operations to/from a column every 62.5 nano seconds. Giving burst transfer rates of 64 million pixels/second between video RAM and Systolic Array. A new window can be opened every 250 nano seconds. The window position can be chosen without any restrictions: Every pixel may be the top left pixel of the window. This assures that algorithms are always independent of a pixels' location.



Each of the four bit slices also has a specialized task:

Bit Slice 0: Mask functions.
Bit Slice 1: Miscellaneous functions, (counters etc).
Bit Slice 2: X address calculations.
Bit Slice 3: Y address calculations.

Which means that complex address calculations can be done in parallel. This architecture designed by DTN speeds up both simple block algorithms as well as algorithms with more complex addressing.

The Systolic Array contains a total of 256 16 bit registers which are all accessible over both the VME bus and the DMB bus. They can be used for data and parameter passing.

DTN GRAPHICS BOARD: FUNCTIONS AND PERFORMANCE FIGURES.

BITBLT FUNCTIONS

BLOCK FILL:.....	**128** million pixels/second.
(with optional vertical gradient)...	(1024x1024 in 8 msec.)
SHIELDED BLOCK FILL:.....	**14.2** million pixels/second.
(with optional vertical gradient)...	(1024x1024 in 75 msec.)
C = !Shielded & (color+y.dcol/dY)...	
¦ Shielded & C	
BLOCK COPY:.....	**21.3** million pixels/second.
C = (!)aA	(1024x1024 in 50 msec.)
A,C : rectangles; a: mult.factor ...	
(!): optional bitwise inversion	
SHIELDED BLOCK COPY:.....	**10.6** million pixels/second.
C = !Shielded & (!)aA ¦ Shielded & C	(1024x1024 in 100 msec.)
A,C : rectangles; a: mult.factor ...	
(!): optional bitwise inversion	
OPERATION ON TWO BLOCKS:.....	**14.2** million pixels/second.
C = (!)aA op (!)bB	(1024x1024 in 75 msec.)
A,B,C: rectangles; a,b: mult.factors	
(!): optional bitwise inversion	
op: operation: plus,minus,and,or,xor	
SHIELDED OPERATION ON TWO BLOCKS:...	**8.0** million pixels/second.
C = !Shielded & ((!)aA op (!)bB)....	(1024x1024 in 125 msec.)
¦ Shielded & C	
A,B,C: rectangles; a,b: mult.factors	
(!): optional bitwise inversion	
op: operation: plus,minus,and,or,xor	
BLOCK ROTATE (0,90,180,270 deg.):...	**10.6** million pixels/second.
C = Rotate[(!)aA] + const	(1024x1024 in 100 msec.)
A,C : rectangles; a: mult.factor ...	(0 deg= 16 Mpixs/second).
(!): optional bitwise inversion	
BLOCK MIRROR (hor,ver,+45,-45)	**10.6** million pixels/second.
C = Mirror[(!)aA] + const	(1024x1024 in 100 msec.)
A,C : rectangles; a: mult.factor ...	(ver= 16 Mpixs/second).
(!): optional bitwise inversion	
BLOCK COMPRESS (2:1 ratio):.....	**26.0** million pixels/second.
	(1024x1024 in 41 msec.)
BLOCK EXPAND (1:2 ratio):.....	**32.0** million pixels/second.
	(1024x1024 in 33 msec.)

DTN GRAPHICS BOARD: FUNCTIONS AND PERFORMANCE FIGURES.

VECTOR DRAWING

CONSTANT COLOR

Any Direction:	line width is 1	4 millionpixels/second.
	line width is 2	8 million pixels/second.
	line width is 3	12 million pixels/second.
	line width is 4	16 million pixels/second.
Vertical:	line width is 1	16 million pixels/second.
	line width is 2	32 million pixels/second.
	line width is 3	48 million pixels/second.
	line width is 4	64 million pixels/second.
Horizontal	line width is 1	32 million pixels/second.
	line width is 2	64 million pixels/second.
	line width is 3	96 million pixels/second.
	line width is 4	128 million pixels/second.

DEPTH QUEING (Gouraud shading).

Any Direction:	line width is 1	4 million pixels/second.
	line width is 2	8 million pixels/second.
	line width is 3	12 million pixels/second.
	line width is 4	16 million pixels/second.

DEPTH QUEING AND PATTERN.

Any Direction:	line width is 1	4 million pixels/second.

VECTOR OPERATIONS.

Any Direction:	line width is 1	
NewVect = ((a*OldVect) XOR b) AND c.		2 million pixels/second.
NewVect = ((a*OldVect) XOR b) OR c.		2 million pixels/second.
NewVect = ((a*OldVect) XOR b) PLUS c.		2 million pixels/second.
a, b and c are constants.		

VECTOR COPY.

Optional Gouraud Shading addition
and intensity multiplication.

Destination Vector is (!)(a * SourceVector)+ Color + r*dCol/dr

Any Direction:	dest pixel is 1x1 ...	2 million pixels/second.
Any Direction:	dest pixel is 2x2 ...	8 million pixels/second.
Any Direction:	dest pixel is 3x3 ...	18 million pixels/second.
Any Direction:	dest pixel is 4x4 ...	32 million pixels/second.
Any Direction:	dest pixel is 8x8 ...	85 million pixels/second.
Any Direction:	dest pixel is 4x8 ...	64 million pixels/second.

DTN GRAPHICS BOARD: FUNCTIONS AND PERFORMANCE FIGURES.

IMAGE PROCESSING FUNCTIONS

CONVOLUTION (2 TO 16 SAMPLE POINTS)
The sample points have a freely programmable offset relative to the moving origin of the convolution.

aplications: nth order derivatives, interpolation, walking average, filtering, pattern matching, feature extraction, etc.

2 point convolution:	12.8 million pixels/second.
3 point convolution:	9.8 million pixels/second.
4 point convolution:	8.0 million pixels/second.
5 point convolution:	6.7 million pixels/second.
9 point convolution:	4.1 million pixels/second.
16 point convolution:	2.5 million pixels/second. (1024x1024 in ... msec.)

TRUE EDGE DETECTION: Root Mean Square value of the X and Y derivates.	4.5 million pixels/second. (1024x1024 in 230 msec.)
ANTI ALIASING: (Reduces the 'staircase effect' of lines drawn on a raster display).	10 million pixels/second. (1024x1024 in 105 msec.)
CORRELATION: (limited precision).	14 million pixels/second. (1024x1024 in 75 msec.)
PROFILING (Horizontal): (Horizontal Mean values).	26 million pixels/second. (1024x1024 in 41 msec.)
PROFILING (Vertical): (Vertical Mean values).	10 million pixels/second. (1024x1024 in 105 msec.)
BINARY SCELETON: (Binary thinnig).	4.0 million pixels/second. (1024x1024 in 260 msec.)
.....	.. million pixels/second. (1024x1024 in .. msec.)
MANY MORE COMMING:	.. million pixels/second. (1024x1024 in .. msec.)

DTN GRAPHICS BOARD: FUNCTIONS AND PERFORMANCE FIGURES.

GRAPHIC RENDERING FUNCTIONS

GOURAUD SHADED QUADRILATERALS & TRIANGLES.

'Standard algorithm'.....

minimal pixel size	1x1	.....	16.0 million pixels/second.
minimal pixel size	1x2	.....	32.0 million pixels/second.
minimal pixel size	1x3	.....	48.0 million pixels/second.
minimal pixel size	1x4	.....	64.0 million pixels/second.
minimal pixel size	1x8	.....	128 million pixels/second.

'High speed algorithm'.....

minimal pixel size	1x1	.....	42.6 million pixels/second.
minimal pixel size	1x2	.....	64.0 million pixels/second.

AFFINE TRANSFORMATION MAPPING ON A QUADRILATERAL WITH TWO VERTICAL EDGES.

minimal pixel size	1x1	.....	3.2 million pixels/second.
minimal pixel size	2x2	.....	8.0 million pixels/second.
minimal pixel size	3x3	.....	18.0 million pixels/second.
minimal pixel size	4x4	.....	32.0 million pixels/second.
minimal pixel size	8x8	.....	85.3 million pixels/second.
minimal pixel size	4x8	.....	64.0 million pixels/second.

QUADRILATERAL TRANSFORMATION: Map an arbitrary quadrilaral onto another arbitrary quadrilateral. Optional Gouraud Shading addition and intensity multiplication.

minimal pixel size	1x1	.....	2.0 million pixels/second.
minimal pixel size	2x2	.....	8.0 million pixels/second.
minimal pixel size	3x3	.....	18.0 million pixels/second.
minimal pixel size	4x4	.....	32.0 million pixels/second.
minimal pixel size	8x8	.....	85.3 million pixels/second.
minimal pixel size	4x8	.....	64.0 million pixels/second.

INCREMENTAL ADDRESS MAP TRANSFORMATION. usable to map a texture on an arbitrary curved surface. Optional addition of shading and intensity multiplication.

minimal pixel size	1x1	.....	2.6 million pixels/second.
minimal pixel size	2x2	.....	9.1 million pixels/second.
minimal pixel size	3x3	.....	16.0 million pixels/second.
minimal pixel size	4x4	.....	28.4 million pixels/second.
minimal pixel size	8x8	.....	78.7 million pixels/second.
minimal pixel size	4x8	.....	56.9 million pixels/second.

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FICHE PRODUIT DE LA CARTE DATAGRAPHIK

Carte graphique très hautes performances, conforme aux normes industrielles et aux standards graphiques

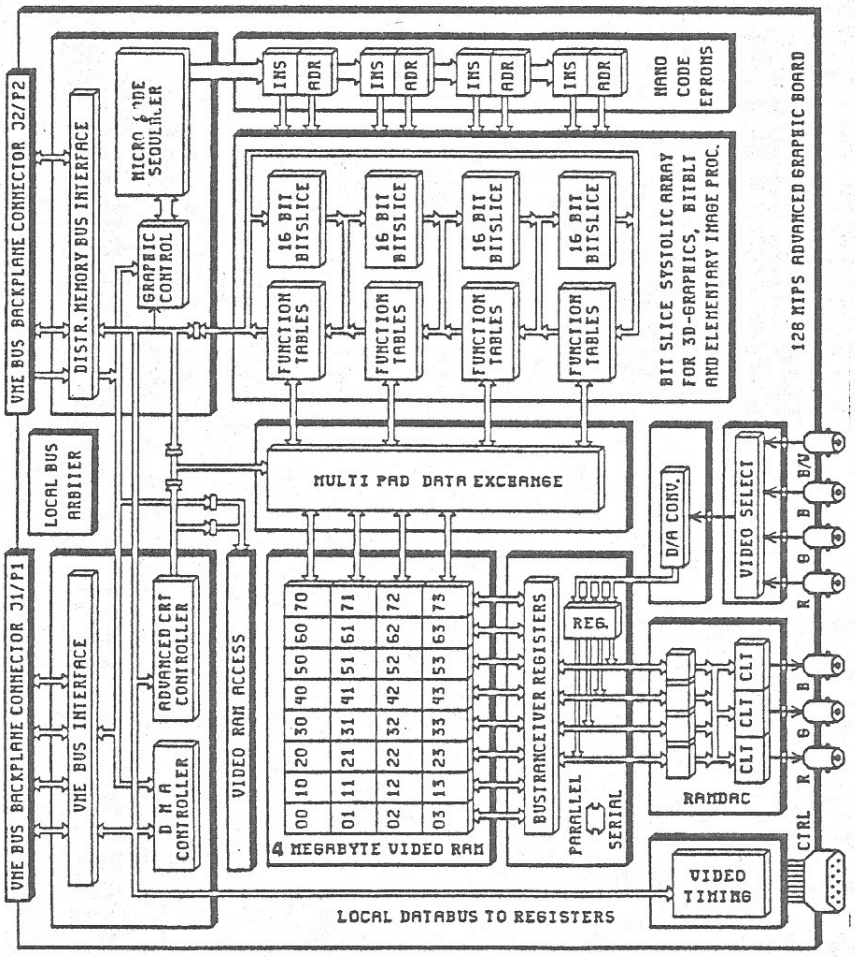

Schéma de principe de la carte **DATAGRAPHIK** pour une application 256 couleurs. Pour obtenir 16 Millions de couleurs simultanément, 3 cartes sont nécessaires.

PRIX

- 135 KF HT pour 256 couleurs simultanées choisies parmi 16 Millions.
- 290 KF HT pour 16 Millions de couleurs simultanées.

INTERET

DATAGRAPHIK s'adapte sur toutes les stations de travail possédant un bus VME et permet d'en accroitre les fonctionnalités et d'en multiplier les performances pour atteindre une puissance de 128 MIPS

ENTREE et SORTIE

Les entrées et les sorties se font sur prise BNC (4 en entrée et 3 en sortie) et, sont programmables aux standards suivants : NTSC, PAL, SECAM, D2MAC, VGA, RVB(1024x1280). La conversion se fait en temps réel dans les 2 sens.

MOTEUR GRAPHIQUE

Le moteur graphique est programmable, ce qui permet son adaptation à tous les standards du marché (X-WINDOW, GKS, PHIGS, PEX,...).

PERFORMANCES

La puissance de 128 MIPS permet l'affichage de 300 000 facettes avec ombrage de Gouraud et élimination des faces cachées par seconde.

APPLICATIONS

- CAO
- Traitement d'image
- Reconnaissance des formes
- Graphique temps réel.