ANGIO Receiver Module

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1 General Remarks

- The module is a two slot wide standard VME Module.
- The required VME address ranges are:
  16 bytes within the short address mode range (**A16, D16**)
  32 MB within the extended address mode range (**A32, D32**).
- The module contains a 72-pin SIMM socket for the picture memory.
  A 16 MB or 32 MB SIMM may be used, the minimum speed is 60 ns.
- The VME base addresses are fixed within a PAL and therefore not switchable. If not specified otherwise the base addresses are:
  short access mode: **0x1100**
  extended access mode: **0x02000000**.
- Power consumption: ~ ? A @ 5 V.

The module is used to control the readout of the ANGIO detector, rearrange the pixel data and store a complete picture within a VME accessable dynamic memory.
The actual revision of the board can be found in the high byte of the status word. The latest revision is **2.**

1.1 Data Files for Programmable Logic

The latest versions of the data for the programmable logic chips can be found in the following files:

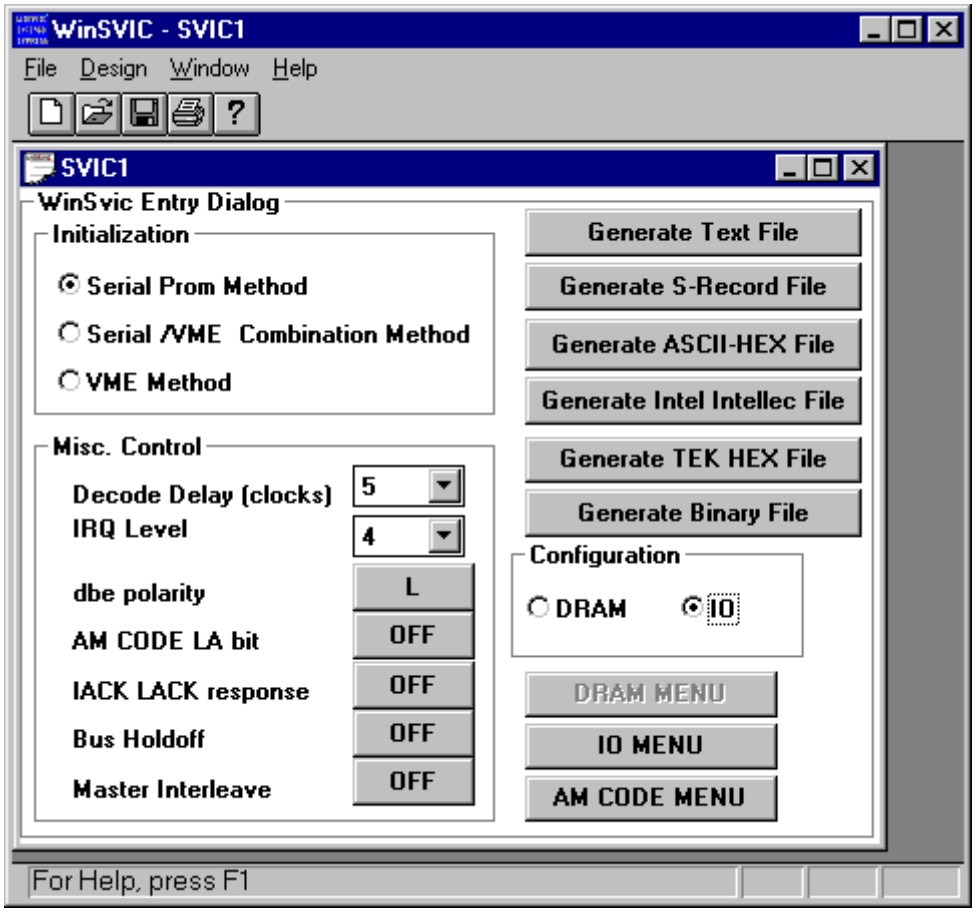
	Chip	Position
VME configuration	ACTEL AT17E65	FEA_VME_P1
VME baseaddress	AMD PALCE22V10	U10
fpga logic (prom 0)	ACTEL 17E256	U9
fpga logic (prom 1)	ACTEL 17E128	U7

2 VME Interface

2.1 Configuration

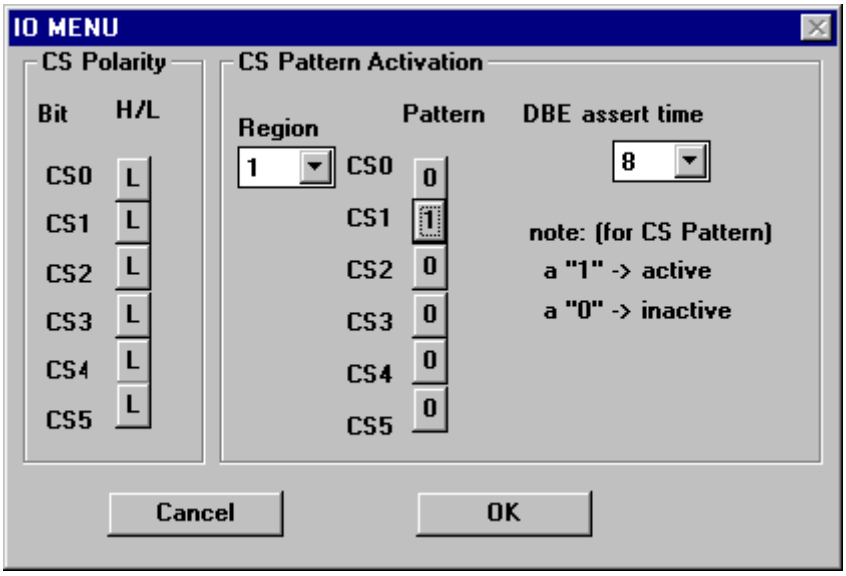
To access the VME bus the standard FEA mezzanine boards "FEA-VME-P1" and "FEA-VME-P2" are used. The modules have to be configured via a serial EEPROM ACTEL "AT17E65" The configuration data are generated with the the program "WinSVIC" (Cypress).

2.1.1 Common Part

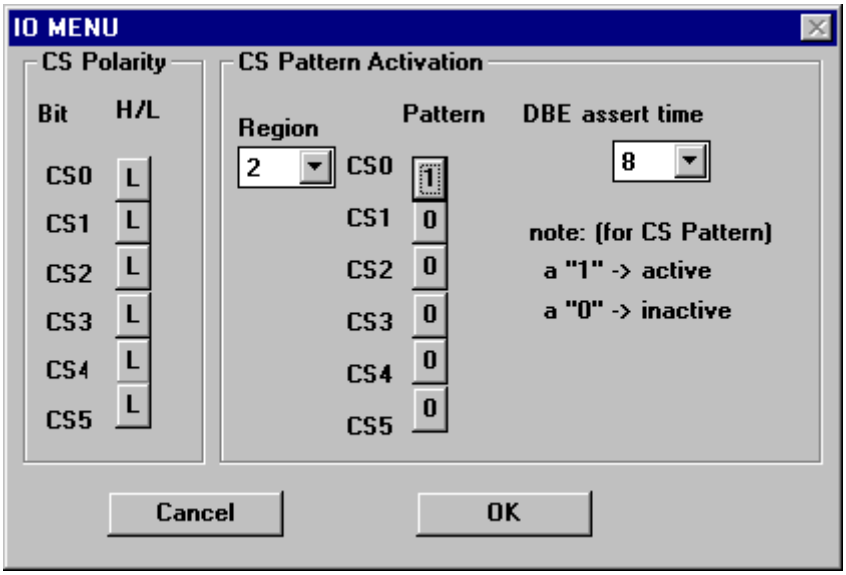


2.1.2 IO MENU Specifications

The interface supports two different regions.
The Region 1 (input signal REG0_) is used for the control commands:

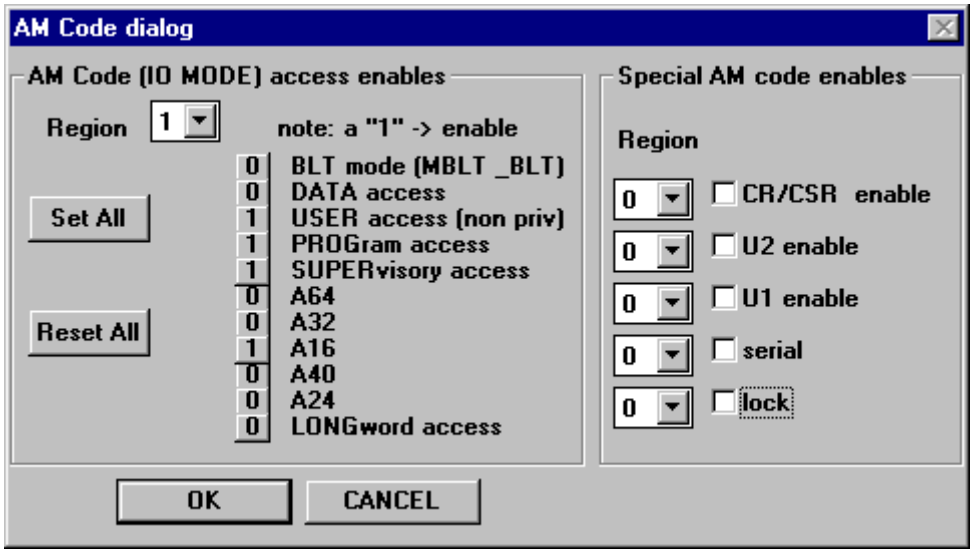


The Region 2 (input signal REG1_) is used for the memory access:

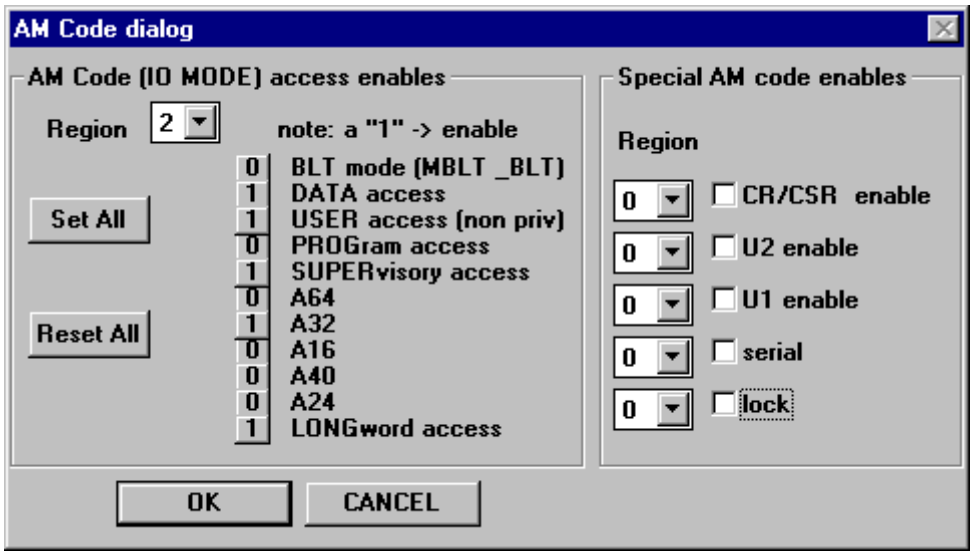


2.1.3 AM CODE MENU Specifications

The control command (Region 1) use the A16 / D16 mode (AM codes '29' and '2D'):



The memory access command (Region 2) use the A32 / D32 mode (AM codes '09' and '0D')



2.2 Control Commands

The control commands use the VME short access mode and 16 bit data words (**A16, D16**).

VME address 15-4 3 2 1 0	+X'..'	READ	WRITE	BITS
IOA . 0 . 0	00	status	begin picture	16/-
IOA . 1 . 0	04	status	write into fiber	15

IOA: VME base address IO access (bits 15...4)
'.': don't care (not decoded)

status bits 15-8: revision code
7-2: not used
1: fiber busy
0: fiber error flag (latched)

2.2.1 Begin Picture Command

The 'Begin Picture' command will set the memory address register to zero and has to be executed each time before starting a picture transfer.

2.2.2 Write into Fiber Command

This command will transfer the rightmost 15 bits to the module at the other end of the fiber link. The bit 15 is the data significance bit and will be added by hardware. The command may be executed at any time.

2.3 Memory Access

The memory access commands use the VME extended access mode and 32 bit data words (**A32, D32**). The memory can be written for test purposes and may be read out at any time (even during picture transfer). The currently used memory size is 16 MB.

3 Picture Data Formats

A picture consists of 1280 double lines of 2 * 336 pixels each (may be extended up to 8192 double lines). Each pixel has 21 data bits and one overflow bit. Because of the detector readout structure the data will be transferred in a bit-serial mode on the rightmost 12 bits of the fiber link data words (a block of 12 pixels at a time), i.e. 21 words are needed for the transfer of 12 pixels. In front of each group of 8 pixel blocks (12 pixels each) the corresponding Overflow Bits are transferred which needs another 8 fiber data words. Besides the parallelization of the pixel information the pixels have to be rearranged (using a lookup table) since they do not arrive in the standard raster scan sequence.

3.1 Fiber Link Data Word

The fiber link transfers one word of 16 bits every 125 ns even if no picture data are requested. One bit is used as a 'data valid flag' to indicate valid information on the pixel bits.

bit 15	bit 14	bit 13	bit 12	bits 11...0
data valid flag	ovfl bit flag	DEAD	SYNC	pixel or ovfl data

data valid flag: 0: word does not contain valid overflow or pixel data
1: word contains valid overflow or pixel data
ovfl bit flag: 0 : data bits contain pixel data
1 : data bits contain overflow data
DEAD : 'DEAD' flag, passed through to LEMO connector
SYNC : 'SYNC' flag, passed through to LEMO connector

3.2 Fiber Link Data Format

Fiber Link Word		bit 14			bit 11	bit 10	bits 9...2	bit 1	bit 0
0		1			OFL Pix 11*	OFL Pix 10*	...	OFL Pix 1*	OFL Pix 0*
1		1			OFL Pix 23*	OFL Pix 22*	...	OFL Pix 13*	OFL Pix 12*
...		...			...	...	...	...	...
6		1			OFL Pix 83*	OFL Pix 82*	...	OFL Pix 73*	OFL Pix 72*
7		1			OFL Pix 95*	OFL Pix 94*	...	OFL Pix 85*	OFL Pix 84*
8		0			Pix 11 bit 20	Pix 10 bit 20	...	Pix 1 bit 20	Pix 0 bit 20
9		0			Pix 11 bit 19	Pix 10 bit 19	...	Pix 1 bit 19	Pix 0 bit 19
...		...			...	...	...	...	...
27		0			Pix 11 bit 1	Pix 10 bit 1	...	Pix 1 bit 1	Pix 0 bit 1
28		0			Pix 11 bit 0	Pix 10 bit 0	...	Pix 1 bit 0	Pix 0 bit 0
29		0			Pix 23 bit 20	Pix 22 bit 20	...	Pix 13 bit 20	Pix 12 bit 20
...		...			...	...	...	...	...
49		0			Pix 23 bit 0	Pix 22 bit 0	...	Pix 13 bit 0	Pix 12 bit 0
...		...			...	...	...	...	...
155		0			Pix 95 bit 20	Pix 94 bit 20	...	Pix 85 bit 20	Pix 84 bit 20
...		...			...	...	...	...	...
175		0			Pix 95 bit 0	Pix 94 bit 0	...	Pix 85 bit 0	Pix 84 bit 0
176		1			OFL Pix 107*	OFL Pix 106*	...	OFL Pix 97*	OFL Pix 96*
...		...			...	...	...	...	...
183		1			OFL Pix 191*	OFL Pix 190*	...	OFL Pix 181*	OFL Pix 180*
184		0			Pix 107 bit 20	Pix 106 bit 20	...	Pix 97 bit 20	Pix 96 bit 20
...		...			...	...	...	...	...
204		0			Pix 107 bit 0	Pix 106 bit 0	...	Pix 97 bit 0	Pix 96 bit 0
...		...			...	...	...	...	...
1056		1			OFL Pix 587*	OFL Pix 586*	...	OFL Pix 577*	OFL Pix 576*
...		...			...	...	...	...	...
1063		1			OFL Pix 671*	OFL Pix 670*	...	OFL Pix 665*	OFL Pix 664*
1064		0			Pix 587 bit 20	Pix 586 bit 20	...	Pix 577 bit 20	Pix 576 bit 20
...		...			...	...	...	...	...
1084		0			Pix 587 bit 0	Pix 586 bit 0	...	Pix 577 bit 0	Pix 576 bit 0
...		...			...	...	...	...	...
1211		0			Pix 671 bit 20	Pix 670 bit 20	...	Pix 665 bit 20	Pix 664 bit 20
...		...			...	...	...	...	...
1231		0			Pix 671 bit 0	Pix 670 bit 0	...	Pix 665 bit 0	Pix 664 bit 0

3.3 Pixel Rearranging Lookup Table

The incoming pixels will be stored one by one into the following memory addresses (relative to the beginning of the double line):

7	63	119	175	231	287	840	784	728	672	616	560
6	62	118	174	230	286	841	785	729	673	617	561
5	61	117	173	229	285	842	786	730	674	618	562
4	60	116	172	228	284	843	787	731	675	619	563
3	59	115	171	227	283	844	788	732	676	620	564
2	58	114	170	226	282	845	789	733	677	621	565
1	57	113	169	225	281	846	790	734	678	622	566
0	56	112	168	224	280	847	791	735	679	623	567
15	71	127	183	239	295	832	776	720	664	608	552
14	70	126	182	238	294	833	777	721	665	609	553
13	69	125	181	237	293	834	778	722	666	610	554
12	68	124	180	236	292	835	779	723	667	611	555
11	67	123	179	235	291	836	780	724	668	612	556
10	66	122	178	234	290	837	781	725	669	613	557
9	65	121	177	233	289	838	782	726	670	614	558
8	64	120	176	232	288	839	783	727	671	615	559
23	79	135	191	247	303	824	768	712	656	600	544
22	78	134	190	246	302	825	769	713	657	601	545
21	77	133	189	245	301	826	770	714	658	602	546
20	76	132	188	244	300	827	771	715	659	603	547
19	75	131	187	243	299	828	772	716	660	604	548
18	74	130	186	242	298	829	773	717	661	605	549
17	73	129	185	241	297	830	774	718	662	606	550
16	72	128	184	240	296	831	775	719	663	607	551
31	87	143	199	255	311	816	760	704	648	592	536
30	86	142	198	254	310	817	761	705	649	593	537
29	85	141	197	253	309	818	762	706	650	594	538
28	84	140	196	252	308	819	763	707	651	595	539
27	83	139	195	251	307	820	764	708	652	596	540
26	82	138	194	250	306	821	765	709	653	597	541
25	81	137	193	249	305	822	766	710	654	598	542
24	80	136	192	248	304	823	767	711	655	599	543
39	95	151	207	263	319	808	752	696	640	584	528
38	94	150	206	262	318	809	753	697	641	585	529
37	93	149	205	261	317	810	754	698	642	586	530
36	92	148	204	260	316	811	755	699	643	587	531
35	91	147	203	259	315	812	756	700	644	588	532
34	90	146	202	258	314	813	757	701	645	589	533
33	89	145	201	257	313	814	758	702	646	590	534
32	88	144	200	256	312	815	759	703	647	591	535
47	103	159	215	271	327	800	744	688	632	576	520
46	102	158	214	270	326	801	745	689	633	577	521
45	101	157	213	269	325	802	746	690	634	578	522
44	100	156	212	268	324	803	747	691	635	579	523
43	99	155	211	267	323	804	748	692	636	580	524
42	98	154	210	266	322	805	749	693	637	581	525
41	97	153	209	265	321	806	750	694	638	582	526
40	96	152	208	264	320	807	751	695	639	583	527
55	111	167	223	279	335	792	736	680	624	568	512
54	110	166	222	278	334	793	737	681	625	569	513
53	109	165	221	277	333	794	738	682	626	570	514
52	108	164	220	276	332	795	739	683	627	571	515
51	107	163	219	275	331	796	740	684	628	572	516
50	106	162	218	274	330	797	741	685	629	573	517
49	105	161	217	273	329	798	742	686	630	574	518
48	104	160	216	272	328	799	743	687	631	575	519

3.4 Memory Data Format

A picture consists of 2560 lines. Currently a 8MB memory is used.

3.4.1 Memory Organisation

Each pixel uses a 32 bit word in memory. Each of the 2560 lines begins on a 512 word boundary, but consists of 336 valid pixels only (the uppermost 176 words are empty).

Memory Address	Content
0...53F	picture line 0, halfline E1
540...7FF	0
800...D3F	picture line 0, halfline E2
D40...FFF	0
...	...
4FF000...4FF53FF	picture line 1279, halfline E1
4FF540..4FF7FF	0
4FF800...4FFD3F	picture line 1279, halfline E2
4FFD40...4FFFFF	0
500000...7FFFFF	not used

3.4.2 Pixel Word Format

Each pixel uses a 32 bit memory word.

bits 31...25	bit 24	bits 23...21	bits 20...0
0	overflow*	0	pixel value

4 Graphical Line Output

To give assistance in detector adjustment the two parts of each received double line are stored (with limited resolution, bits 19...8 only) into special memories. The content of these memories are read out with a higher frequency all the time and and fed into two Analog-toDigital-Converters. Using the also generated 'Start Line Pulse' as a trigger the two lines may be easily shown on a standard scope.
Pixels with overflow bit 'on' are replaced by zero values.

5 Front Panel Connectors

On the front panel are the following connectors:

- Fiber Link Connector
  The fiber link receiver module is a SIEMENS FC 266 Mbaud Transceiver (266 Mbaud, 1270-1380 nm, SC Receptacle).
  The fiber cable to be used is a preassembled Duplex cable (multimode, core diameter 62.5 µm) with SC-connectors (e.g. SIEMENS V23859-C2103-Axxx, xxx = length in meters).
- SIG-E1 Connector
  Standard LEMO Connector (DESY 26217), analog representation of the line E1 (0...10V)
- SIG-E2 Connector
  Standard LEMO Connector (DESY 26217), analog representation of the line E2 (0...10V)
- START Connector
  Standard LEMO Connector (DESY 26217), trigger signal for E1 and E2
  (drives 50 Ohm terminated line)
- SYNC Connector
  Standard LEMO Connector (DESY 26217), 'SYNC' signal from bit 12 of the fiber link input
  (drives 50 Ohm terminated line)
- DEAD Connector
  Standard LEMO Connector (DESY 26217), 'DEAD' signal from bit 12 of the fiber link input
  (drives 50 Ohm terminated line)

6 Revision History

- **21-Jan-99:** revision **1**
- **18-Mar-99:** analog output locic redesigned (-> revision **2**)